

## **Bull Breeding Soundness Examination: Review and Update**

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### **Introduction**

Breeding soundness examination (BSE) of bulls is a relatively simple examination process primarily intended to identify bulls that are subfertile or infertile. The BSE is critically value management tool for producers who utilize bulls in a natural service breeding program. A thorough and complete BSE can help minimize the risk of poor reproductive performance in the beef cow herd and therefore serve as sort of an insurance policy for producers. Several review articles over bull BSE's have been published recently.<sup>1-3</sup> The Society for Theriogenology (SFT) has recently updated its guidelines for bull BSE and the updated manual can be found on the SFT website.

### **Value of a BSE**

The primary value of the BSE is the identification of bulls that are on the lower end of the fertility spectrum in order to minimize the risk poor reproductive performance due to bull fertility. Various studies have reported that up to 25% of bulls will fail an initial BSE.<sup>4,5</sup> Identifying these less fertile bulls prior to breeding season is a huge benefit to beef producers. Selecting bulls with at least 80% normal sperm morphology increased pregnancy rate 5-6% compared to randomly selected bulls even though all bulls in the study has passed a BSE.<sup>6</sup>

### **Components of a BSE**

A typical breeding soundness exam consists of four parts: physical examination, measurement of scrotal circumference and evaluation of semen motility and morphology. In order for a BSE to provide the most benefit to the producer, each component of the exam must be conducted in a complete and thorough manner. Performing each BSE in a consistent and repeatable manner will ensure that the results are as accurate as possible.

#### *Physical Examination*

Physical examination of the bull starts with an assessment of the overall general appearance of the animal. The practitioner should record the age and breed as well as any identification present. If any regulatory health testing is going to be performed or if the bull is going to need a certificate of veterinary inspection, an official form of identification should be applied if one is not already present. Body condition score should be assessed and recorded. The bull should be evaluated for structural correctness of his feet and legs and for the presence of any lameness. The eyes should be evaluated to ensure that the bull has functional vision. Musculoskeletal soundness and intact vision are critical for a bull's ability to find cows in estrus, mount and breed them successfully.

Physical evaluation of the reproductive tract follows the overall general evaluation. Once the bull is adequately restrained, the author starts this portion of the exam by palpating the scrotum and its contents. Ideally palpation is performed using both hands at the same time so that both sides of the scrotum can be compared simultaneously. Palpation should start at the scrotal neck near the body wall and proceed distally. The examiner should identify each spermatic cord, the head of each epididymis, each testicle and the tail of each epididymis. The body of the epididymis is difficult to palpate unless it is enlarged. Each structure should be similar in size and firmness to its counterpart. As a reference, the testicles should be similar in firmness to a racquetball. Measurement of scrotal circumference completes the evaluation of the scrotum and its contents and will be discussed in more detail below. The penis and prepuce should then be carefully palpated for any abnormalities. The author prefers to start by identifying the penis near the base of the scrotum. The penis is then palpated distally until the glans is identified within the sheath. Often, penile fibropapillomas can be identified at this stage before the penis is exteriorized. Palpation is then continued distally along the prepuce to the preputial orifice or opening of the sheath. Swelling around the penis just cranial to the base of the scrotum usually represents a previous penile hematoma. Swelling midway between the scrotum and the preputial orifice is usually the result of a preputial abscess. Swelling or firmness of the prepuce generally indicates a preputial injury or

scar tissue formation from a previous injury. These abnormalities are important to identify because each one can interfere with the bull's ability to extend the penis to breed cows.

The next phase of the physical exam is the evaluation of the internal reproductive organs via rectal palpation. The structures that should be identified and evaluated are the pelvic portion of the penis, the prostate, the paired seminal vesicles, the paired ampullae and the internal inguinal rings. The pelvic portion of the penis is embedded in muscle but it can be readily identified as it typically pulses in response to the pressure from the examiners hand. The transverse ridge of the prostate can be palpated on the dorsal aspect of the penis approximately half way between the anus and the pelvic rim. It has been described as feeling like a wedding band on a finger. The rest of the prostate is embedded in muscle and cannot be palpated. The seminal vesicles are paired, lobulated structures located just cranial and lateral to the prostate. They are attached at the base near the prostate but are otherwise freely moveable. Size of the seminal vesicles varies with the age and maturity of the bull. They may range in size from thumb size in young bulls to palm size in mature bulls. They should be similar in size from side to side and should be distinctly lobulated. If they are asymmetric, smooth, or painful to the touch, the bull likely has seminal vesiculitis. The ampullae are paired tubular structures that can be palpated near midline just cranial to the prostate. As they course cranially over the rim of the pelvis, they become smaller and more difficult to palpate. Palpable abnormalities of the ampullae are uncommon. While not technically a reproductive organ, the internal inguinal rings should also be evaluated. They can be palpated as a small slit in the body wall approximately six inches below the pelvic rim and a few inches either side of midline. In most bulls, no more than two to three fingers can be inserted into the ring. If the rings are much larger, the bull has increased risk of developing an inguinal hernia. All components of the physical exam must be within normal limits for a bull to pass the BSE.

#### *Measurement of Scrotal Circumference*

Scrotal circumference (SC) can be easily measured as part of the physical exam. Scrotal circumference is an important trait for a variety of reasons. There is a direct correlation between larger SC and sperm production capacity. Sperm production capacity influences the number of cows a bull can service in a given time frame which can impact how quickly cows become pregnant in the breeding season. Scrotal circumference is also related to fertility of offspring in that heifers sired by bulls with larger SC, tend to reach puberty earlier than heifers sired by bulls with smaller SC. Meeting age appropriate requirements for scrotal circumference is one of the requirements for passing a BSE. The SFT has published recommended SC minimums for bulls of different age. The minimum SC for bulls less than 15 months is 30 cm. The minimum SC measurement increases by 1 cm for every 3 months of age until 24 months. A bull over 24 months of age should have a SC of greater than 34 cm. If a practitioner performs BSE on the same bulls for several years, measuring SC may also help detect age related changes that can impact fertility. If SC measurements begin to decrease in mature bulls, it is likely that those bulls are experiencing testicular degeneration. To obtain accurate SC measurements the testicles should be gently squeezed down into the scrotum so that wrinkles in the scrotal skin are removed and the measurement taken around the widest circumference. The measuring device should be snug but not so tight as to indent the scrotal skin. Repeating the measurement can help ensure accuracy.

#### *Semen Collection and Evaluation*

Semen collection can be accomplished in a variety of ways. The use of teaser animals and an artificial vagina can be used to collect bulls that are used to being handled. This method will provide a semen sample that most closely represents the bull's true production potential. This method is difficult to use in the performance of routine BSE's. Semen can be collected from some bulls by trans-rectal massage of the internal reproductive organs. This method is inconsistent and time consuming and often produces a very small sample. For the purposes of performing a BSE, most bulls will be collected via electroejaculation (EE). The use of EE can also help complete a thorough physical exam as most bulls will obtain erection and protrusion of the penis allowing the examiner to visualize the prepuce and glans penis.

During collection and evaluation, semen samples should be protected from extreme environmental temperatures to avoid iatrogenic artifacts in motility and morphology. Both gross and individual motility should be assessed as quickly as possible after collection. Gross motility is evaluated

by placing a drop of semen on a warm glass slide and observing under low power magnification. Gross motility evaluation provides an assessment of concentration as well as the degree to which sperm cells are moving. It is important to remember that a sample collected by EE is not necessarily representative of a bull's production capacity so a dilute sample does not necessarily mean that a bull will produce poorly concentrated semen. The SFT recommendations for scoring gross motility are Very Good (rapid dark swirling), Good (slower swirls and eddies), Fair (no swirls but general oscillation or individual cell motion) and Poor (sporadic oscillation with little or no individual cell motion). Gross motility is influenced by concentration as well as motility. A dilute semen sample with good motility will not produce the rapid dark swirls seen with more concentrated samples. It is important to remember that gross motility does not provide as assessment of progressive motility. A sample could contain a high percentage of cells swimming backward or in circles and still have good gross motility. The SFT has recently revised the standards for passing a BSE and one of the changes is that gross motility scores are no longer adequate for determining the motility assessment portion of the exam. The bull must meet the minimum score for individual progressive motility in order to pass the BSE. Individual motility is assessed by placing a diluted sample of semen on a warm slide with a coverslip. Semen can be diluted with warm physiologic saline. The goal is to dilute the sample so that individual cells can be visualized. The examiner should view several fields of view and estimate the percentage of cells that are moving in a linear fashion. Cells swimming backwards, in circles, or wiggling in place are not considered progressive. The minimum progressive motility score is 30%.

Evaluation of sperm morphology is the final step in evaluating a semen sample. Morphology evaluation is performed by preparing a stained slide and observing the cells under high magnification. Performing morphology under low power magnification is inadequate because subtle defects such as nuclear vacuoles, acrosome defects or diadem defects can be missed. Eosin-nigrosin stain is the most common stain used for routine BSE. This stain is a live-dead stain meaning that it will differentiate cells that were alive or dead at the time of staining. Live cells will be unstained on dark background. Cells that were dead or degenerating at the time of staining will appear varying degrees of pink. Stained slides can be prepared in a variety of ways but it is important that the practitioner develop a technique that consistently produces high quality slides without damaging the cells.

Morphologic abnormalities can be categorized under a variety of systems. The most common system used currently classifies abnormalities as primary, secondary or tertiary. Primary abnormalities typically involve the head and are thought to originate during spermatogenesis. Secondary abnormalities involve the midpiece or tail and are thought to originate in the epididymis. Tertiary abnormalities are iatrogenic due to sample handling errors or environmental stressors. This system is imperfect though because some abnormalities can be classified as either primary or secondary. Other categorization systems include major and minor defects or compensable and non-compensable defects. Recent revision of the BSE standards by the SFT have led to the adoption of a classification system where abnormalities are categorized as head, midpiece or tail defects and the most common abnormalities observed are listed in each category. Also as part of the recent revisions, some abnormalities are no longer considered abnormal. Distal cytoplasmic droplets and abaxial attachment of the midpiece are no longer considered abnormal under the revised guidelines. Although the categorization system has been revised, the minimum passing score or 70% morphologically normal cells has not changed.

### **BSE Outcomes**

Following completion of a BSE a bull can be classified as a Satisfactory Potential Breeder, Unsatisfactory Potential Breeder or as Classification Deferred. In order to be classified as satisfactory, the bull must have a normal physical exam, meet the minimum age appropriate scrotal circumference, have at least 30% progressively motile sperm and have at least 70% morphologically normal sperm. If the bulls fails to meet these criteria but is thought to have a reasonable prognosis for improvement, he is typically classified as Classification Deferred and a date is recommended for re-evaluation. If a bull fails to meet the minimum criteria and is thought to have a poor prognosis for improvement or has failed to meet the minimum criteria on repeated exams, he should be classified as an Unsatisfactory Potential Breeder. If a bull is physically normal the author will rarely use the unsatisfactory classification until the bull has failed to meet the minimum criteria on multiple exams.

## Limitations of a BSE

It is important to recognize that routine BSE has some significant limitations. A routine BSE is most effective at identifying bulls on the lower end of the fertility spectrum. A BSE says that a bull has met the set of established minimum criteria but does not evaluate or rank bull's fertility beyond that minimum. A BSE provides an assessment of fertility at the time of the examination. When investigating poor herd reproductive performance, a BSE may not reflect the bull's fertility during the previous breeding season. Fertility can change due to a variety of factors so it is important that a BSE is performed prior to each breeding season. Certain penile abnormalities such as ventral deviation or corkscrew cannot be detected during a routine BSE. A routine BSE also cannot evaluate libido. Producers should be encouraged to watch closely to make sure bulls are successfully breeding cows even when those bulls have been classified as Satisfactory Potential Breeders.

## Conclusions

The bull BSE is useful and economical service that veterinarians can readily provide for their clients. Guidelines established by the SFT should be followed to provide consistency and accuracy when performing BSE's. SFT guidelines for bull BSE have been recently updated. Distal cytoplasmic droplets and abaxial tails are no longer considered abnormal. Progressive motility scores must now be based on individual motility. Gross motility scores are no longer acceptable. Additionally, the sperm cell classification system of primary and secondary abnormalities is being abandoned. The recommended classification system is now head, midpiece and tail abnormalities with space provided to write in the most common defects observed. In order to be classified as a satisfactory potential breeder, a bull must have a normal physical exam, meet age appropriate minimums for scrotal circumference, have at least 30% progressively normal sperm and have at least 70% normal sperm cell morphology. Readers are referred to the new SFT bull BSE manual for more details.

## References

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