A renewed emphasis on breeding soundness evaluations in the bull

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Introduction

The commercial and seedstock cattle industry and the veterinary profession have relied upon the bovine Breeding Soundness Evaluation since the 1940's. Over the years it has served the industry well with minor adaptations to account for new knowledge of bull and sperm parameters as well as genetic gain. The time has come again to re-evaluate the system incorporating new technologies and science. If this adaptation occurs, it will be judged against evidence based knowledge and wide input from all aspects of the industry including producers, breed associations and the veterinary profession. The scope of this evolution could also involve risk assessment due to genetic abnormalities due to the advent of genomic testing making identification much quicker and more accurate than in the past.

Historical perspective

The standards set forth today owe it beginning to the Society for Theriogenology which had a humble beginning in 1954 when a dozen veterinarians came together to better understand why so many bulls became infertile following the winter of 1954 in the Rocky Mountain states. (Chenoweth, et.al. 1992) This origin utilized 4 parameters to evaluate bulls. It included sperm "vigor", live/dead, sperm concentration and morphology. Of these original areas of interest in 1954, only morphology is still utilized today. One of the first studies utilizing these parameters analyzed over 10,000 bulls on the western slope in Colorado. (Carroll, et.al. 1963). This study showed the ability to evaluate large numbers of bulls utilizing the criteria from the Society using electrostimulation.

The next evolution of the bull BSE came in 1976 when C.J. Bierschwal, after evaluating over 3,000 bulls utilizing the "old" system compared to the new system which now utilized scrotal circumference, motility, morphology and removed live/dead criteria. (Bierschwal, C.J. 1976) The new system used a numerical system placing 40 percent on scrotal circumference, 20 percent on motility and 40 percent on morphology. The previous system held up for many years, but as more data and research evolved, it became evident that changes needed to be made.

The next step in the evolution of the bull BSE began in 1990 at the Society for Theriogenology meeting in Toronto. There was dissatisfaction with the numerical scoring system used to date and nomenclature used to classify each bull following evaluation. It was found that a bull could reach a passing score of 70 percent yet fail in one of the three areas of evaluation. In addition, the term "Questionable Potential Breeder" was dropped in favor of "Classification Deferred" due to perceptual concerns by clients that it unfairly labelled young bulls that had not reached sexual maturity. (Chenoweth, et.al. 1992). After considerable debate and meetings, the current standards employed today were adopted along with a new Breeding Soundness Evaluation form.

Current standards

Based on the work of Bierschwal and later Chenoweth, the current standards employed today consist of a general physical exam to include internal and external genitalia, scrotal circumference, motility and morphology. These standards are not based on a numerical system, but rather a pass/fail for each category.

Scrotal circumference

In 1992, this area of discussion was particularly problematic. It was determined that the use of scrotal circumference was employed to protect the Minimum for all bulls. Discussion of breed differences and differing age of maturity based on breed led to the following minimums being established for all breeds. (Chenoweth, et.al. 1992) The following is the current minimums by age used for todays BSEs.

Table 1. Current Scrotal Circumference by Age in Bulls by the Society for Theriogenology

Age	S.C. (cm.)
≤ 15 mo.	30 cm.
>15 mo. ≤18 mo.	31 cm.
>18 mo. ≤21 mo.	32 cm.
>21 mo. ≤24 mo.	33 cm.
>24 mo.	34 cm.

Other countries have made significant changes to their scrotal circumference minimums and have incorporated breed differences into their analysis. (Walder, C.L. et.al. 2010), (Fordyce, G. et.al. 2006), (Irons, P.C. et.al. 2007). The changes noted, by country, were established in conjunction with individual breed associations and took into account specie differentiation.

Motility

Today's standards for motility are predicated upon the use of gross or individual motility. As seen in other countries such as South Africa (Irons, P.C., et.al. 2007), concentration does not play an important role in the United States system. Processing errors and temperature control play a critical role in this evaluation. A minimum of 30 percent Progressively Motile Sperm Cells are required to pass this portion of the BSE. Although this appears to be a low percent to pass, it was incorporated at this rate due to major differences in semen handling that could occur between evaluators.

Table 2. Motility Standards for the Bull BSE from the Society for Theriogenology

Gross Motility	Rating	Individual Motility
Rapid Swirling	Very Good	≥ 70 percent
Slower Swirling	Good	50 to 69 percent
Generalized Oscillation	Fair	30 to 49 percent
Sporatic Oscillation	Poor	< 30 percent

A minimum of Fair Gross Motility or 30 percent individual motility needed to pass a BSE.

Morphology

This has been the one area of the breeding soundness evaluation that has been researched extensively and is prime to be revamped in the near future. A minimum of 70 percent normal cells are needed to pass the Society for Theriogenology BSE. This threshold appears to be a fair standard and does differ from other countries such as Canada where they use a 75 percent normal minimum. (Waldner, C.L. et.al. 2010). More bulls fail a BSE due to morphology than any other criteria. (Carson, R. et.al. 2014). Over time, morphology has been categorized as either Primary vs. Secondary, Major vs. Minor or Compensable vs. Non-Compensable. The standard by the Society for Theriogenology utilizes Primary vs. Secondary. Generally,

it is thought that Primary abnormalities arise during spermatogenesis in the testicle, while Secondary abnormalities are a function of maturation in the epididymis. Using this criteria can be used to determine prognosis and retest times.

Table 3. Primary and Secondary abnormalities from the Society for Theriogenology

Primary Abnormalities	Secondary Abnormalities
Underdeveloped	Small normal heads
Double heads / tails	Giant or short broad heads
Acrosome defects	Free normal heads
Pyriform heads	Detached, folded, loose acrosmal membranes
Diadem Defects	Abaxial tails
DAG Defects	Distal droplets
Small or Free Abnormal heads	Slightly bent tails
Proximal droplets	Terminally coiled tails
Strongly coiled tails	
	Other Cells
	Epithelial Cells
	RBC/WBC
	Spheroids

The complete Breeding Soundness Evaluation in the bulls utilizes the physical exam, scrotal circumference, motility and morphology which yields one of three possible outcomes. The bull can be classified as either a Satisfactory Potential Breeder, Classification Deferred, or an Unsatisfactory Potential Breeder. Many young sires will fall into the Classification Deferred category during their first test and should be retested in 30 to 60 days before being classified as either a Satisfactory or Unsatisfactory Potential Breeder.

It is important to note what the BSE is not. It is not a guarantee of future fertility or a statement concerning the libido of the bull. This can only be evaluated by observation of the bull in a breeding environment.

Economics

Determining the value of testing your bulls prior to the breeding season is a difficult task to put to paper due to numerous factors. The cost of a BSE is generally around $50.00 per head. When calculating the serviceability of the bull, which can range from 20 to 40 cows per bull, equates to $0.80 to $2.50 per cow to cover the cost of the BSE. This is less than the cost of a single vaccine for the cow.

The risks analysis that can be used depends on the number of bulls in the bull battery servicing the appropriate number of cows on pasture. One bull servicing 20 cows that is not tested and subsequently found infertile has devastating consequences on the calf crop. It will be zero calves, thus an extremely high risk. Having one bull in a battery of 7 bulls, turn out to be infertile, will generally yield a normal calf crop, but can have an extended calving season yielding lighter calves at weaning. Unfortunately, the producers with one bull is generally the one that does not test their bulls prior to the season. Larger herds tend to test annually to ensure the highest pregnancy rate in the first, second and third 21 day period.

Changes on the horizon

The Society for Theriogenology is in the midst of updating the Breeding Soundness Evaluation in bulls. Nothing to date has been determined, but areas of concern to be looked at are an increase in minimum

scrotal circumference, possible breed differences, possible increase in motility standards, and a fresh look at morphological abnormalities. These potential changes will be considered if evidence based science points in that direction and it is agreed to by producers, breed associations and veterinarians.

Summary

The history of the BSE has shown us that it is truly a living document. As genetics progress and science clarifies aspects of the BSE, we have to be ready to update and utilize the latest and most progressive data that we have. Understanding the importance of the BSE in producers herds is critical in selling this technology to producers. Unfortunately, many of our current clients and producers do not do annual BSE until they have been burnt by a bad bull that cost them major dollars. Those individuals will never not test their bulls again.

References

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