New Guidelines for the Evaluation of Bulls For Breeding Soundness

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Abstract

New guidelines for bull breeding soundness examinations (BSE) were recently adopted by the American Society for Theriogenology. Major new features included the abandonment of numerical scores in favor of threshold values which must be achieved for scrotal circumference (minimum threshold of 30 cm at 15 months of age), spermatozoal motility (minimum threshold of 30% individual motility) and spermatozoal morphology (minimum threshold of 70% normal sperm). The latter requirement is seen to reduce the emphasis on classification systems (e.g. "primary" and "secondary" abnormalities) for sperm morphology assessment. Bulls are classified as being either "satisfactory" or "unsatisfactory" or they are placed in a "classification deferred" category. Forms and explanatory notes are available to members of the society for Theriogenology from the Society office.

Introduction

From its inception almost 40 years ago and through several modifications, the Breeding Soundness Evaluation (BSE) has aimed to be an effective and economic procedure for screening bulls prior to sale or use. It has become a proven tool in the improvement of herd fertility and, conversely, an essential component of infertility investigations. Despite changes in emphasis, the components of the BSE have remained essentially similar as follows:

1. General physical examination.
2. Reproductive examination (which has included a scrotal circumference measurement since 1975).
3. Collection and examination of semen.

In addition, tests for libido and/or serving capacity may be included, as may special tests for diseases such as Vibriosis or Trichomoniasis. Although these procedures can increase the accuracy of bull fertility prediction, and some may be specifically indicated in certain situations, they are not generally part of the routine BSE.

The BSE has undergone several revisions over the years to accomodate increasing and changing knowledge. Although the procedure has been effective in placing bulls into groups or categories which generally perform as predicted, it has not been so effective in consistently predicting individual bull fertility. Some possible reasons for the variability encountered with individual bull fertility prediction may include:

1. Fertility is a complex trait, influenced by both male and female traits as well as by extraneous factors.
2. The BSE is a relatively quick and simple screening procedure which does not attempt to comprehensively assess all aspects of male fertility.
3. Our knowledge and understanding keep increasing and changing.

This latter consideration, i.e. the inexorable advance of knowledge, mandated a review of the current bull BSE procedures which have been in effect since 1975. Various meetings and discussions commencing in 1990 culminated in the revised system which was presented to the Annual General Meeting of the Society for Theriogenology in August 1992. An important objective with the new system was to keep it as simple and as free from ambiguity as possible. Another objective was to foster a system which would continue to have relevance in many different environments and with diverse bull genotypes.

Major Features

1. **Bulls must pass recommended *minimum standards* for scrotal circumference, sperm motility and sperm morphology.**

In the new system, the bull must pass **ALL** minimum standards, i.e for scrotal circumference, sperm motility and sperm morphology. With the previous numerical scoring system bulls could be classified as "satisfactory" despite being very deficient in one or more categories. This could occur because the total composite score was high enough to give a passing grade. In addition, numerical scores could be used to "rank" bulls in terms of potential reproductive performance. Both

approaches were capable of error and misrepresentation, especially as the original intention of numerical scores was to help place bulls in categories or groups. In general, each of the threshold standards selected are not overly rigorous. However, the requirement for bulls to pass in all categories does mitigate against any impression of leniency; early experience indicates that the new system is not causing more bulls to be classified as "satisfactory" than hitherto. Of course, the use of higher thresholds by veterinarians with clients, seedstock breeders and their associations is encouraged where feasible.

2. Scrotal circumference thresholds.

Relatively low thresholds for scrotal circumference were selected for the different bull age categories. *These represent minimal acceptable measures for all bulls, regardless of genotype or environment.* Most emphasis is placed on standards for pubertal bulls up to 2 years of age (i.e. the most common and probably most important test population). Variations will occur with age, nutrition level and genotype. Here, the use of low thresholds provides considerable latitude, although more with some genotypes than others. Again, these thresholds are based upon considerations of reproductive adequacy. Where scrotal circumference measures are being used to achieve tangible genetic progress in either male or female fertility traits, higher thresholds may be used dependent upon genotype, environment and client objectives.

Scrotal Circumference Thresholds
Minimum Recommended Scrotal Circumference

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

3. Bulls must achieve a progressive motility threshold of 30 percent (or "fair").

In the new system, bulls must achieve values of 30 percent (or greater) for individual sperm motility, or a "fair" classification (or better) for gross motility. While these thresholds are relatively low, they reflect the trend to downplay the significance of sperm motility values *when these are obtained under field conditions*; a trend which commenced with the 1975 revision of the BSE. Some considered that these thresholds should be higher while others questioned the inclusion of any estimate of sperm motility in the BSE at all. Taking into account the varied and often trying conditions encountered in the

field, a higher threshold might well be an obstacle to general acceptance of this scheme, or at least to its proper observance. It should be realized that this relatively low threshold in no way diminishes the potential importance of the sperm motility assessment when performed under optimal conditions.

Mass Activity (Gross Motility)	Rating
Rapid Swirling	Very Good (VG)
Slower Swirling	Good (G)
Generalized Oscillation	Fair (F)
Sporadic Oscillation	Poor (P)

Percent Progressive Motility	Rating	
≥ 70%	Very Good	(VG)
50 - 69%	Good	(G)
30 - 49%	Fair	(F)
< 30%	Poor	(P)

4. Bulls must achieve a single threshold for sperm morphology (≥ 70% Normal).

The practice of separately classifying various sperm abnormalities as "primary" and "secondary" has been severely challenged. This is because this sytem was based upon erroneous assumptions concerning the etiology and significance of sperm abnormalities. The selection of a 70% threshold for normal sperm is loosely based upon the results of Wiltbank (1982) and is close to the 75% level recommended by Barth and Oko (1989).

The requirement for 70% or more normal sperm for a bull to pass the BSE *does not make any distinction between types of abnormalities involved.* However, the categories of "primary" and "secondary" sperm abnormalities are nevertheless retained on the form to assist in the mechanics of collating totals, as well as to help monitor bulls. A strong case was made to change the categories to "major" and "minor" as described by Blom (1972). However, the lists of sperm abnormalities in each system proved to be so similar that a decision was made to retain the system with which most people were familiar. A newer system, that of "compensable" and "uncompensable" abnormalities, shows considerable promise even though the classification lists are far from complete. However, with the use of a composite total for normal sperm it does not matter which system is used to arrive at the end result. In fact, employment of a single threshold for total sperm morphology should lessen both the emphasis and debate on the significance of particular categories of abnormality in relation to bull fertility.

Categories of Sperm Abnormalities

"Primary" Abnormalities	"Secondary" Abnormalities
Underdeveloped	Small normal heads
Double forms	Giant & short broad heads
Acrosome defects (e.g. Knob)	Free normal heads
Crater-Diadem defect	Detached, folded, loose
Pear-shape head	acrosome membranes
Abnormal head contour	Abaxial midpiece
Small & free abnormal heads	Distal droplet
Proximal droplet	Simple bent tail
Double bent & coiled tail	Terminal coiled tail
Accessory tail	

5. A "Classification Deferred" category replaces the "Questionable" category.

Although the "questionable" category has been used for many years, it was open to misinterpretation. This category was usually regarded as a temporary one for a bull pending a retest. Bulls could be placed in this category for many reasons including an unwillingness by the examiner to make a final prognosis at that juncture. Whatever the reason for its application, the term "questionable potential breeder" could be interpreted as being unfair to some bulls.

The substitution of a "classification deferred" category, a description which has neutral connotations, does not have such disadvantages. However, its use does imply that a retest will be scheduled.

6. SUMMARY.

For bulls to be classified as _Satisfactory Potential Breeders_, they must pass the physical examination and equal or exceed the minimum thresholds in each of the following categories:

Category	Threshold
- _Scrotal Circumference_	30 cm at ≤ 15 mo
	31 cm at >15 ≤ 18 mo
	32 cm at >18 ≤ 21 mo
	33 cm at >21 ≤ 24 mo
	34 cm at > 24 mo
- _Sperm Morphology_	≥70% normal sperm
- _Sperm Motility_	≥30% individual motility &/or "fair" gross motility

Bull Classifications

Satisfactory:

Bulls which equal or surpass the minimum thresholds for scrotal circumference, sperm motility and sperm morphology, and which do not show genetic, infectious or other problems or faults which could compromise breeding or fertility.

Unsatisfactory:

Bulls which are below one or more thresholds and which are highly unlikely to ever improve their status. Also, bulls which show genetic faults or irrevocable physical problems (including infectious disease) which would compromise breeding or fertility.

Classification Deferred:

Any bull which does not fit into the above categories and which could benefit from a retest. This category would include bulls with an immature semen picture and/or whose semen is below par but who could well improve. Also in this category are bulls from whom a satisfactory ejaculate could not be obtained for unknown reasons as well as bulls with treatable problems such as seminal vesiculitis or footrot. In general, if any doubt exists about a bull fitting into either the satisfactory or unsatisfactory categories, he should be considered as a candidate for a retest.

Forms

Forms are available to ACT members from:

Society for Theriogenology
Association Offices
2727 W. 2nd Street
Hastings, Nebraska 68902-2118

Key References

1. Ball, L., Ott, R.S., Mortimer, R.G. and Simons, J.C. Manual for Breeding Soundness Examination of Bulls. 1983. _J. Soc. Theriogenology_, No. XI1. 65 pp. 2. Barth, A.L. and Oko, R.J. _Abnormal Morphology of Bovine Spermatozoa._ 1989. Iowa State University Press. 3. Bierschwal, C.J.: Revised Breeding Soundness Procedures. 1976. _Proc. Soc. for Theriogenology AGM_, Lexington, Kentucky p. 128. 4. Blom, E.: The Ultrastructure of Some Characteristic Sperm Defects and a Proposal for a New Classification of the Bull Spermiogram. 1972. Atti del VIII. Simposio Int. di Zootechnia. Milan. pp 125-139. 5. Carroll, E.J., Ball, L. and Scott, J.A.: Breeding Soundness in Bulls - a Summary of 10,940 Examinations. 1963. _J.A.V.M.A._ 142:1105. 6. Chenoweth, P.J.: Examination of Bulls for Libido and Breeding Ability. in _Veterinary Clinics of North America. Symposium on Herd Health Management - Cow-Calf and Feedlot._ 1983. W.B. Saunders Co., Philadelphia. p. 59. 7. Chenoweth, P.J. and Ball, L.: Breeding Soundness Evaluation in Bulls. in ed. D.A. Morrow _Current Therapy in Theriogenology._ 1980. W.B. Saunders Co., Philadelphia. p. 330. 8. Chenoweth, P.J., Spitzer, J.C., Hopkins, F.M. and Larsen, R.E. A New Bull Breeding Soundness Evaluation Form. 1992. _Proc. Soc. for Theriogenology AGM_, San Antonio, Texas, p. 63. 9. Lagerlof, N.: Changes in the Spermatozoa and in the Testes of Bulls with Impaired or Enhanced Fertility. 1934. _Acta. Path. et Microbiol. Scand. Suppl._ 19. 10. Larsen, R.E. and Chenoweth, P.J.: Diadem/Crater Defects in Spermatozoa from Two Related Angus Bulls. 1990. _Molec. Repro. and Devel._ 25:87. 11. Ott, R.S. Current Thinking on Breeding Soundness Examination of Bulls. 1987. _Proc. Soc. for Theriogenology AGM_, Austin, Texas. p.14. 12. Saacke, R.G., De Jarnette, J.M., Nebel, R.L. and Nadir, S.: Assessing Bull Fertility. 1991. _Proc. Soc. Theriogenology AGM_, San Diego, California. p. 56. 13. Spitzer, J.C., Hopkins, F.M., Webster, H.W., Kirkpatrick, F.D. and Hill, H.S.: Breeding Soundness Examination of Yearling Beef Bulls. 1988. _J.A.V.M.A._ 193:1075. 14. Vogler, C.J.: Effects of Elevated Testicular Temperature on Viability of Cryopreserved Semen and Morphological Characteristics of Ejaculated Spermatozoa. 1990. _M.S. Thesis_, Virginia Polytechnic Inst., Blacksburg, Va. 15. Wiltbank, J.N. and Parish, N.: Evaluation of Bulls for Potential Fertility. 1982. _Proc. Soc. for Theriogenology AGM_, Milwaukee, Wisconsin. p. 141.