



BULL BREEDING SOUNDNESS EVALUATION

The Bull Statue, Macroom. The bull has always had a significant symbolic role in Irish culture and mythology.

Donal Murphy MVB Cert DHH, a veterinary practitioner in Sliabh Luachra Veterinary Centre, Rathmore, Co. Kerry, provides a guide to bull breeding soundness evaluation

Bull breeding soundness evaluation (BBSE) is a procedure that has been carried out for close to 20 years in Ireland. It is a very effective way of distinguishing bulls that have a very high chance of breeding, from bulls that are clearly not suitable. In essence, it is a means of establishing the 'fitness for purpose' of a bull, and bulls that do not measure up to the key criteria can be removed from the national breeding programme.

Our grass-based dairy and beef production systems are highly seasonal, which means it is vital that the stock bull is fertile, and the recent upsurge in the use of sexed semen means that the demands on the bull are even greater. Therefore, we must strive to ensure that the bulls used on farms have the best possible chance of being successful. International data for many years suggests that, at any one time, approximately three per cent of bulls are infertile, and that 20 to 25 per cent of bulls are sub-fertile. An infertile or sub-fertile bull can have a devastating effect on farm profitability. An infertile bull cannot achieve pregnancies, while a sub-fertile bull can achieve pregnancies, but not with the same success rate as a fertile bull. Neither condition is necessarily permanent, meaning that an infertile bull may recover. It is also worth noting that a bull that is fertile today, may suffer some insult, infectious or otherwise, that may render him sub-fertile or infertile sometime in the future.

A fertile bull is defined as being capable of getting 90 per cent of 50 normal, disease-free, cycling females pregnant in a nine-week period.¹

What's involved in a BBSE?

In a BBSE, a physical examination of the bull is undertaken, as well as a detailed examination of the sex organs, both internal and external. A semen sample is obtained by electroejaculation, which is microscopically examined, and three key parameters are measured, namely gross motility and progressive motility of the sperm, and finally sperm morphology. If the bull reaches the internationally accepted minimum standards for these three exercises, and if his scrotal circumference (SC) exceeds the target for his age, then he is deemed to have passed the BBSE, and may be certified as such, assuming he has also passed the physical examination.

Physical examination

The bull's heart and lungs are auscultated with a stethoscope. The eyes and mouth are assessed while the bull is restrained in the crush, and the musculoskeletal system is best examined while the bull is entering or exiting the crush. All of these may have an impact on the bull's ability to search out cows in heat, and on his ability to deposit semen in the cow's vagina.

Internal and external sex glands and organs

A detailed examination of the testes must be carried out. This involves palpation (checking for testicular tone and consistency), while also ensuring that the testes are freely mobile within the scrotum. The epididymides are also examined at this point, with the epididymal tail found ventral to the testis on left and right, and the epididymal heads cranial to the testes. Any abnormalities are noted, and gross abnormalities here will usually result in sperm defects. The SC is measured with a bespoke measuring tape. It is measured at the widest point, where one hand is used at the neck of the scrotum to hold the testes firm, while the tape is used with the free hand. There are strict minimum measurements that must be reached here, ranging from 30cm SC at 12-15 months of age, to 34cm SC at 24 months of age.²

The SC can be influenced by many factors including genetics, breed, and state of nutrition – both recent and in calthood. The SC is recorded and it is a really important component of the BBSE.

At this point, a rectal examination is performed. The bulbo-urethral and prostate glands may be palpated but they are really of no significance in the BBSE. However, the prostate which runs horizontally across the urethra like a “speed ramp” serves as a simple landmark making it easy to locate the seminal vesicles, which feel almost like a bunch of grapes, on the left and right side, roughly at the level of the prostate. Seminal vesiculitis is not uncommon, is often associated with an ipsilateral epididymitis, and is sore to the touch if acute. Chronic seminal vesiculitis is not painful, and some older bulls will have hard indurated seminal vesicles which do not appear to affect sperm quality. However, acute seminal vesiculitis often results in frank pus in the semen sample collected and will result in failure of the BBSE. Cranial to the prostate are the ampullae which are the two terminal portions of the left and right vas deferens. They don't really have clinical significance, but gentle rhythmic stimulation of the ampullae can result in the bull becoming stimulated and dropping his penis. This can be valuable if the bull subsequently doesn't extrude the penis during electroejaculation, because a bull cannot pass a BBSE if the penis is not visualised.

For both the testicular and the rectal examinations, an ultrasound scan can also be performed. While it is not a requisite part of the BBSE, it is a very valuable tool to further examine any suspicious findings, and the male organs are particularly amenable to using ultrasound. The 5 MH probe, which is the most popular for cattle vets, is the probe of choice³.

Electroejaculation

Electroejaculation has been used for decades in the bovine for semen collection. While some of the earlier models were crude in their action, the latest models of electroejaculator allow for quick and easy collection of semen samples that are, in every way, comparable to an artificial vagina sample, which is the gold standard. Factors that can influence the ease of the semen collection include: the quality of the machine, the quality of the restraint (usually a crush), the skill of the operator, and having a non-slip floor. The ease of collection is directly related to the comfort of the bull throughout the procedure, which is of paramount

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Joanna McNally: +44 7887 422 565

Eugene Smyth: 086 821 0912 Sean Parke: 086 821 0418

1. Pogge et al. J. Anim. Sci. 2012;90:2692–2698. 2. Machado et al. Vet J. 2013;197(2):451–6. 3. Dzermejkaitė et al. Poster presented at: XXIV Middle European Buiatrics Congress, Kosice, Slovakia, 7th–10th May 2025

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Visualisation of the penis is important so conditions such as persistent frenulum can be identified.

importance from a welfare viewpoint.

Essentially, a probe is placed in the rectum of the bull, through which a gentle voltage is applied. This stimulation increases smoothly until the ejaculatory threshold is reached resulting in the bull emitting the semen into a ready plastic funnel or directly into a vial. In almost all cases, the penis is extruded which allows a detailed examination of the penis to be carried out. Warts are the most common penile abnormality found.

There are a number of automatic programmes built into modern electroejaculators. These differ in the strength of the voltage supplied, and factors such as the age or size of the bull would dictate the choice made regarding selecting a programme. Some bulls respond better to a slower process, while a better sample can be collected from other bulls



Detached heads, such as seen in the centre of this smear, are one of the most common defects identified during a morphological exam.



A Lane Pulsator V is the most commonly available electroejaculator currently available in Ireland.



Penile warts are not an uncommon finding during a BBSE.

with a more rapid higher voltage programme. Selecting an automatic programme means that both the operator's hands and eyes can be fully focused on the bull.

As well as the automatic programmes, there is a manual programme on the machine which allows the operator to fully control the strength of the voltage supplied and the speed at which it is increased. This is done by selecting buttons of increasing voltage and by using a rheostat wheel for finer tuning. While my personal preference is for the automatic programmes, the manual mode is a skill that is well worth learning, because not all bulls respond to the automatic stimulation in the same way, and sometimes a sample can only be collected via the manual mode.

Semen & sperm evaluation

The key assessments here are gross motility, progressive motility and sperm morphology. Gross motility is done under low magnification on the microscope, progressive motility under higher magnification, and sperm morphology is done at the highest magnification (x1000), using oil immersion.

Semen handling

Handling the semen from the moment it is collected until the initial part of the analysis is done is of paramount importance. This is especially true regarding temperature. It is vital to try to keep the temperature of the sample at 37°C from when it enters the vial to when it is examined under the microscope. Therefore, a water bath or preferably a heated

block is an essential piece of kit. The heated block is a better option, because there is a risk of the water bath being overturned and spilt, in the often less than ideal conditions where this work is being undertaken.

As well as the semen sample being at the correct temperature, the slides, cover slips, and stain that are to be used must also be kept at 37°C. This is achieved either by using a heated stage which fits on to the microscope, or by using a slide warmer. Both should be set to 37°C, and by having the semen and the slides at a consistent temperature, "cold shock" which effectively paralyses the sperm will not occur. Cold shock would result in a very erroneous analysis of the sample

Initial examination

The semen sample once collected can be viewed, and classified as watery, milky, or creamy. Obviously, a creamy sample is far more desirable, and a watery sample is not a good sign. The volume of the sample collected can be recorded, but the volume per se is of no importance. Other things that can be recorded from the initial gross visual examination could include the presence of blood or frank pus in the sample, or whether the sample is contaminated by faeces or urine.

Gross motility

Using an insulin syringe, a little drop of semen about 0.5cm wide is placed on the heated slide and observed at the lowest magnification. Gross motility is scored between zero and five, where zero is absolutely no movement in the sample and five is dark angry waves of motion. A minimum score of three is required here. Factors that influence the gross motility are:

- (1) density of the sample, i.e., sperm numbers;
- (2) the vigour of the individual sperm; and,
- (3) temperature of the sample.

While this is a subjective measure, it is very quick and effective, and while one may deliberate as to whether a sample scores a three or a four, the difference between a two and a four is dramatic.

Progressive motility

The progressive motility is a measure of the percentage of sperm that are actively swimming in straight lines. For this, a much smaller drop of semen, 0.1 to 0.2mm, is put on the slide, on to which is placed a warmed cover slip. It may help to dilute the sample with PBS (phosphate-buffered saline) or it can also be diluted with seminal fluid that can be harvested from the bull during the early part of the electroejaculation. An estimate of the percentage of sperm swimming in straight lines must be made, and the internationally accepted minimum here is 60 per cent. Magnifications of x100 to x400 are used for this, and having a phase contrast facility in the microscope is hugely beneficial. For the beginner, this is the most difficult parameter to assess but it does help to just concentrate on one corner of your viewing field.

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References: 1. T. van Weeren, F. et al. 2013. Comparison of two intravaginal progesterone releasing devices (PRID[®] Delta vs CDR[®]) in dairy cows: Blood progesterone profile and field fertility. *Animal Reproduction Science* 138:143 – 149. 2. Silva LOE, Valenza A, Alves ROR, Silva MAD, Silva TBR, Motta JCL, Drum JM, Madureza G, Souza AH, Sartori R. Progesterone release profile and follicular development in Holstein cows receiving intravaginal progesterone devices. *Theriogenology*. 2021 Sep; 15:172-207-215. Patrick Lenehan. Influence of progesterone on oocyte quality and embryo development in cows. *Theriogenology* 76 (2011) 1594–1601. 3. M. C. Wilbank, A. H. Souza, P. D. Carvalho, A. P. Cunha, J. O. Giordano, P. M. Fricks, G. M. Baez and M. G. Diskin. Physiological and practical effects of progesterone on reproduction in dairy cattle. *Animal* (2014), 8(3), pp 70–81. 4. Lopes, H., L. D. Sotter and M. C. Wilbank. 2004. Relationship between level of milk production and estrous behavior of lactating dairy cows. *Anim Reprod Sci* 81(2004):209–223. 5. Bloch, A., et al. Endocrine Alterations Associated with Extended Time Interval Between Estrus and Ovulation in High-Yield Dairy Cows. *Journal of Dairy Science*, 2006, 89(12): p. 4694–4702. 6. Walker, W.L., R.L. Niebel, and M.L. McGilliard. Time of Ovulation Relative to Mounting Activity in D of Dairy Science, 1996, 79(9): p. 1555–1561. 7. P. Llaneras, L. O'Hara, N. Forde. Role of diestrus progesterone on endometrial function and conceptus development in cattle. *Anim. Reprod.*, v10, n3, p.223–227, Jul./Sept. 2013. 8. Rivera PA, Mendonca LGD, Lopes G, Santos BP, Penez RV, Amisaldem M, Correa-Caldem A and Chebel RC. 2011. Reduced progesterone concentration during growth of the first follicular wave affects embryo quality but has no effect on embryo survival post transfer in lactating dairy cows. *Reproduction* 141(2011), 333–342. 9. Diskin MG, Murphy JJ, Sreenan JM. Embryo survival in dairy cows managed under pasture conditions. *Anim Reprod Sci* 2016;96:297–311.

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Sperm morphology

This is probably the single most important criterion to be assessed⁴. Nigrosin-Eosin stain is used, which allows easy estimation of the percentage live and percentage dead sperm. The ratio of stain to semen is very important, as too much of either makes it impossible to read the slide. Again, using the insulin syringe, a drop of semen is added to a drop of warmed stain on the slide. A smear can be made with another slide using the classic push and drag method, but I far prefer to use the barrel of the insulin syringe to make the smear. Gently place the syringe barrel on the mixed stain/semen to allow it to spread the full width of the slide and then streak it to the end of the slide making plenty of ridges as you do. The ridges will mean that you will almost certainly have some part of the smear where your slide/stain ratio will be optimal.

There are dozens of morphological defects of bovine sperm⁵, descriptions of which are far beyond the scope of this article. When performing the sperm morphology assessment, 100 sperm are counted moving around the slide, using x1000 magnification, with oil immersion essential. The numbers of normal sperm are counted, and the number and types of abnormal sperm are also counted and recorded. A minimum of 70 per cent normal sperm is what is needed here.

I never do the sperm morphology examination on farm. The slide must be allowed to dry fully before you do this, and I far prefer to do this back at the surgery where conditions are more favourable. Slide mailers are very cheap and easily available, and they protect your slides and keep them dust-free until the morphology examination is done.

Summary

A BBSE is a very effective way of assessing bull fertility. It can be used for bulls pre-sale, where a vendor needs a certificate, and it can be used pre-breeding in bought-in bulls. Some herdowners test all their bulls pre-breeding every year, and it can also be used post-breeding where there may be a suspicion that the bull is not functioning as well as he should. Farmers see and appreciate the value in the service.

Remember the key targets:

- scrotal circumference, ranging from 30cm at 12 months to 34cm from two years old;
- gross motility, a score from three to five;
- progressive motility, 60 per cent; and,
- sperm morphology, 70 per cent.

Finally, one should always be vigilant when working with bulls; try to ensure that the facilities provided are safe, and never turn your back on a bull.

References

1. Entwistle & Fordyce. Evaluating and Reporting Bull Fertility, AACV, 2003
2. Alexander J. Bull breeding soundness evaluation: a practitioner's perspective. Theriogenology, 2008;70:469-472
3. Luc DesCoteaux, Jill Colloton, Giovanni Gnemmi. Ruminant and Camelid Reproductive Ultrasonography. First Edition 2010 Wiley Blackwell
4. Richard M. Hopper. Bovine Reproduction. First Edition 2015 John Wiley & Sons
5. Barth A, Oko R. Abnormal Morphology of Bovine Spermatozoa. Ames, IA: Iowa State University Press, 1989.

READER QUESTIONS AND ANSWERS

1. WHAT DOES BBSE STAND FOR?

- A. Bovine bacterial screening evaluation
- B. Bull breeding soundness exam
- C. Basic bull semen extraction
- D. Breeding bull safety examination

2. WHAT THREE KEY PARAMETERS ARE EVALUATED IN A BULL SEMEN ANALYSIS?

- A. Sperm concentration, semen colour, scrotal circumference
- B. Testicular size, libido score, ejaculate volume
- C. pH, white blood cell count, semen temperature
- D. Gross motility, progressive motility, and morphology

3. WHAT IS ASSESSED DURING A SCROTAL EXAM?

- A. Penile length, preputial hair density, and sheath colour
- B. Rectal temperature, heart rate, and rumen fill
- C. Hoof angle, body condition score, and tail tone
- D. Testicular size, tone and consistency, and the epididymides

4. WHAT INTERNAL BULL ORGANS CAN BE PALPATED PER RECTUM?

- A. Kidneys, adrenal glands, ureters and spleen
- B. Testicles, scrotal skin, epididymal tail, and spermatic cord
- C. Abomasum, rumen, mesenteric lymph nodes, and pancreas
- D. Bulbo-urethral glands, prostate, seminal vesicles, and ampulae

5. WHAT CRITERIA ARE NECESSARY FOR SEMEN TO PASS THE MORPHOLOGY ASSESSMENT?

- A. At least 50 per cent live sperm with no visible contamination at x400 magnification
- B. A sperm concentration of >500 million/mL regardless of structural defects
- C. Fewer than 30 per cent proximal droplets observed under x200 magnification
- D. A minimum of 70 per cent normal sperm when a prepared slide is examined under x1000 magnification

ANSWERS: 1B; 2D; 3D; 4D; 5D.