Bull breeding soundness exam

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looks at the bull breeding soundness examination introduced into the UK in 2010 and its usefulness in determining bull fertility and herd economics

ABSTRACT

This article aims to highlight a range of areas relating to bull breeding soundness examination (BBSE), including background to the importance and relevance of bull fertility and a brief general overview of suckler herd economics. This is followed by a review of some of the features of the examination as a whole (rather than semen collection).

Keywords: bull, semen, beef, BBSE

BULL breeding soundness examination (BBSE) is a routine procedure in the US, Canada and Australia. However, it appears less commonly practised in the UK, with a standard bull breeding certification system only being introduced in 2010 (BCVA, 2010; Penny, 2010).

Bulls reaching the minimum requirements for a BBSE have been found to achieve a nine per cent higher group pregnancy rate (proportion of females pregnant after being run with a bull for a defined period; Penny, 2009). This shows the value of BBSEs and is supported by a number of studies. At least 20 per cent of unselected breeding bulls may be found to be infertile or sub-fertile and between 30 per cent and 40 per cent fail evaluations (Carson and Wenzel, 1997; Carrol et al, 1963; Kennedy et al, 2002).

A study of bulls on 72 farms in Scotland showed an average fail rate of 33.4 per cent, increasing to 52 per cent in bulls older than six years of age (Eppink et al, 2005). Walters et al (2011) surveyed 314 bulls in southern England finding 29.5 per cent were sub-fertile. Only 60 per cent and 49.4 per cent respectively of those failing could be identified by physical examination alone (Eppink et al, 2005; Penny, 2009; Penny, 2010; Walters and Thomson, 2011).

Economics

Efficiency in beef herds is determined by reproductive efficiency, calf mortality, growth rates and quality of the end product, with a measured outcome being the weight of calf weaned per female bred per year (Lowman, 1988; Statham et al, 2007; Caldow et al, 2007; Caldow et al, 2005; McGowan, 2004).

A profitable beef farm will aim for a calving season of less than 10 weeks with greater than 65 per cent of the cows calving in the first 21 days (Penny, 2009). Bull fertility is often a key driver of this measure and is, therefore, important to quantify.

Extension of the 365-day target calving interval (CI) has been estimated to cost £1/cow per day (Statham et al, 2007). It is probable the cost has increased since then as this estimate was based on a Livestock Meat Commission costing in 2005. In the subsequent 10 years fixed costs such as land rent and finance costs and variable costs such as fertiliser, concentrate and forages have increased dramatically. Therefore, the cost per day of an increase in CI could well be greater than £1/cow per day.

The cost of extending the calving interval is due to a range of factors. These include rearing fewer calves, weaning a lower calf weight per cow per year, uneven weaned groups increasing management costs (because tasks such as castration cannot be performed at the same time), increasing number of cows found barren at the end of the season and increased feed costs (Statham et al, 2007).

If UK performance mirrors recent figures from the Irish Cattle Breeders Federation in the Republic of Ireland where the average calving interval is 406 days for all suckler herds, significant additional costs are being incurred by many beef suckler enterprises (Teagasc, 2010).

Bull costs can be extremely high and are a significant loss if a bull does not sire any or enough calves per year over the course of its productive lifespan (**Table 1**).

Bull rotation or increasing the number of bull per group increases bulls cost per calf and potentially decreases genetic advancement of herds.

If clients had more confidence in bulls as a result of pre-breeding assessments they might buy fewer higher quality bulls without increasing spend or bull-to-female ratio.

For example, a 90-cow suckler herd with an estimated increase in CI by 21 days would be expected to lose £1,890 over a breeding season if we assume costs remain at 2005 levels.

Table 1. Annual bull cost per calf produced (£). Bull purchase price is assumed as £2,500 with maintenance costs of £200 per year. The table illustrates the benefits of purchasing a bull that is long-lived and fecund (EBLEX, 2014).

Number of seasons used	Number of calves sired per year			
	10	20	30	40
1	£330	£165	£110	£83
3	£143	£72	£48	£36
5	£106	£53	£35	£27
7	£90	£45	£30	£23
9	£81	£41	£27	£20

Table 2. The effect of high versus medium energy diets on Hereford bulls from weaning to 24 months. Services were measured over two 30-minute libido tests (McGowan, 2003).

Trait	Medium energy	High energy
Number of bulls	8	8
Bodyweight average (kg)	578	796
Back fat thickness average (mm)	5.4	39.9
Epididymal sperm reserves	40.6	19.8
Sperm motility average (%)	66	35
Abnormal sperm average (%)	22	64
Number of services	55	5

Serving capacity and libido assessment

BBSEs are not a guarantee of fertility but of the probability of fertility. It has been found that 4.8 per cent of bulls passing a BBSE failed to serve cows, so it should be remembered semen evaluation gives no indication of libido, and bulls should be closely observed at work or a serving assessment performed (Penny, 2010; Eppink et al, 2005; AACV, 2002).

Serving assessments are not commonly performed in the UK although they appear to be commonly used to rank and assess mating behaviour in Australia. The Australian Association of Cattle Veterinarians (AACV; 2002) provides a check list to assess soundness for breeding, with compulsory requirements being at least one serve within 10 minutes, a normal penis, normal musculoskeletal function and no other observed issues that may limit a bull's ability to serve.

Libido is moderately heritable and bulls with high libido (high service capacity) are likely to achieve acceptable pregnancy rates (McGowan, 2003).

Body condition score

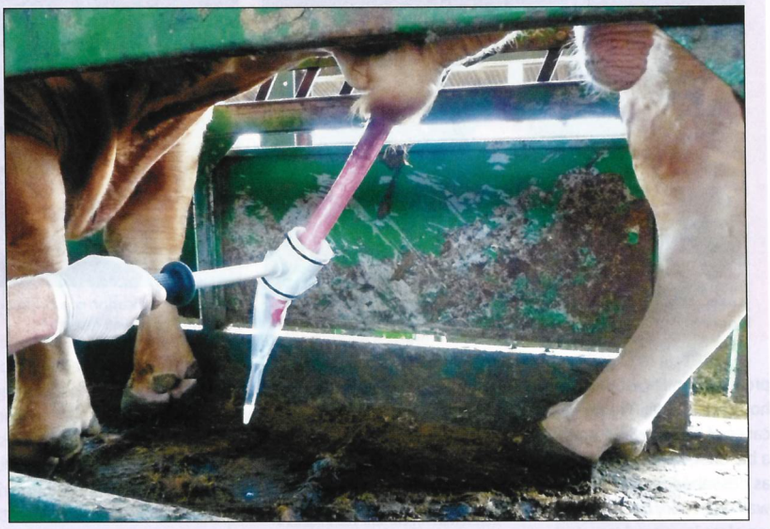
A smaller proportion of bulls with a body condition score (BCS) of ≤2 and ≥4 have semen of satisfactory quality relative to those of BCS 2.5 to 3.5 (Barth and Waldner, 2002).

Fat deposition around the testicles in bulls of BCS ≥4 affects thermoregulation, influencing sperm motility and morphology. Bulls of poorer BCS or those losing excessive condition will show testicular degeneration, resulting in poor reproductive parameters (Barth and Waldner, 2002; AACV, 2002).

As shown in **Table 2**, plane of nutrition can also have significant effects on sperm reserves, motility, morphology and libido.

Incisor/dental pad alignment

Assessment of the jaw and teeth for problems such as an overshot/undershot jaw should be performed although in many instances it may have already been identified by the owner.



Collection of a semen sample.

IMAGES: Rose Jackson.

Bull effectively restrained in crush with halter to prevent head movement. Access to the prepuce for semen collection is made easy with the opening sides.

Musculoskeletal system

Examination of the musculoskeletal system has shown five per cent of bulls have leg and feet problems (AACV, 2002). Physical abnormalities of feet/legs do not affect semen quality. However, these will affect the bull's long-term performance, with 31 per cent of UK bulls being culled for musculoskeletal issues (Penny et al, 2001). Physical abnormalities will also have a major impact on serving capacity.

Ocular examination

Examination of the eyes is carried out to identify scarring from infectious bovine keratoconjunctivitis or early signs of squamous cell carcinoma. Ocular examination is important as bulls must be able to seek out females in oestrus, mount and serve without delay (AACV, 2002; Barth and Waldner, 2002; Penny et al, 2001).

Internal accessory glands

Rectal palpation of accessory sex glands is important, especially in young bulls. Young bulls are most commonly diagnosed with seminal vesiculitis. This presents with swelling, loss of lobulation, pain on palpation or electroejaculation (EEJ) being found. Blood and pus may also be found in the semen. This condition may be associated with high energy diets fed to young bulls (AACV, 2002; McGowan, 2003).

External genitalia

The scrotum, testicles and epididymis are carefully examined to ensure absence of orchitis, epididymitis, hernias or vesicles. This is done by assessing tone and resilience of the testicle and palpation of the neck of the scrotum. Slight variation in size, shape and position is considered normal and allowed. Scrotal skin should be pliable with no thickening.

The penis should be observed during the serving assessment or if erection is achieved during EEJ. If not, careful palpation of the sheath should be performed. This is to confirm the absence of common conditions of the penis such as penile deviation, trauma, fibro-papillomata and balanoposthitis (AACV, 2002; Penny, 2010)

Scrotal circumference

Scrotal circumference (SC) is a good indicator of sperm production capacity. It is highly heritable and

hence influences male offspring SC and is also genetically associated with fertility of female offspring (AACV, 2002; Penny, 2010).

Bulls below minimum SC should be considered as having testicular hypoplasia and being subfertile (Penny, 2010). SC is also strongly correlated with sperm motility and morphology (AACV, 2002; Barth and Waldner, 2002; BCVA, 2010; Penny, 2010). BCVA certificate targets should be followed, although where breed societies' guidelines already exist these should also be referred to.

Semen density and appearance

Density of the semen sample is of little value as concentration can vary as a result of collection method and is poorly related to fertility (AACV, 2002; Penny et al, 2005).

Gross motility

Gross motility is evaluated by placing an undiluted drop of semen on to a warmed slide under 100 times magnification. It is determined by the concentration, proportion progressively motile and speed of progression and an arbitrary scale of one to five is used.

This should only be used as guide as it is poorly correlated with fertility, although it is suggested bulls scoring ≥3 tend to have good progressive motility if semen is handled appropriately (AACV, 2002; Penny, 2010). Barth and Waldner (2002) suggest a high correlation between gross motility and morphology. However, good gross motility may be achieved even with a large number of dead sperm (AACV, 2002).

Progressive motility

Progressive motility is assessed by diluting the semen sample and examining using warmed slides and coverslips and viewed at a magnification of 100 to 400 times. The accepted minimum standard is 30 per cent and this is supported by AACV (2002) where the acceptable minimum standard for natural mating is ≥30 per cent (Penny, 2005). Logue and Grieg (1987) state ≥50 per cent is desirable. However, the BCVA Pre-Breeding Examination requires ≥60 per cent and AACV primary threshold is also ≥60 per cent as some bulls may provide semen for freezing.

Progressive motility is well correlated with bull fertility, therefore this is an important measurement.

Morphology

Morphology is assessed by making a smear of the diluted semen sample with warmed stain; the most commonly used being eosin-nigrosin.

The internationally accepted standard for sperm morphology to achieve good fertility is ≥70 per cent normal. This measure is strongly correlated with fertility (Barth and Waldner, 2002).

High levels of morphological abnormalities clearly indicate degenerative changes or hypoplasia of the testicles and/or epididymis. The most common defect seen in bull ejaculates are bent tails, although this defect should be interpreted carefully as it may be an artefact as a result of prolonged contact with stain or cold shock due to poor handling and environmental conditions. A detailed discussion of morphological abnormalities can be found in Barth and Oko (1989).

At least three ejaculates should be collected and examined before a bull is failed or recommended for testing on another day. As spermatogenesis and epididymal passage takes roughly two-and-a-half months, it must be remembered what we examine today is a historic representation of testicular function, and thereby this period must be allowed before re-evaluation.

Summary

This article outlines a protocol and some of the potential benefits of BBSE and why discussion of reproductive performance should be a core part of the relationship between vets and beef suckler clients.

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