Choosing the Right Bull to Pass on the Desired Genetics for a Central Australian Herd

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Introduction

Bull fertility continues to be critical to the profitability of central Australian beef herds. It is the essential ingredient for pastoralists to be able to both plan their breeding program for the future direction of the herd and also determine the number and suitability of turn-off animals to meet market specification. Within the fertility measures there are genetic components and immediate or physical measures. The genetic components collectively have low heritability but individually provide opportunity to make progress. There are a number of physical measures that tell us something about the bull's immediate potential to sire calves. No single fertility related trait is able to consistently predict a bull's fertility. However, a number of traits have been demonstrated to collectively influence the calf-getting ability of a bull. These traits include scrotal circumference, semen quality (particularly percentage of normal spermatozoa), sheath depth, thickness of the umbilicus, heparin binding protein and mating behaviour (mounts and mounts plus serves). Assessment of many of these traits is included in a bull Breeding Soundness Examination (BBSE) provided by the Australian Association of Cattle Veterinarians.

Background

Bull fertility has long been recognised as a major determinant of herd profitability and has a bigger influence as age of turn-off decreases. The benefits for selection pressure on fertility are greater particularly relative to lower herd fertility (eg measured by conception rate or branding rate relative to a mating period. Many pastoralists are not always confident as to how 'forceful' they should be when asking for information regarding a bull's fertility; if in fact they are confident as to 'what pieces of information' they need. To help pastoralists make better decisions, a research group involving The Queensland Department Primary Industries, University of Queensland, Australian Institute of Tropical Veterinary and Animal Science and the Northern Territory Department of Primary Industries and Fisheries investigated the relative contribution of a range of fertility measures in tropically adapted bulls (eg Brahman, Santa Gertrudis and Belmont Red bulls). The bulls used in the studies were subject to rigorous selection pressure by the stud managers and bulls with undesirable structure were not included in the trial groups.

Locations

The study was conducted on 3 research stations and 8 cooperator properties in Queensland and 1 research farm in the Northern Territory. The measures investigated were those related to structural soundness, scrotal circumference, semen quality, sheath and prepuce structure and umbilical size and mating performance using 20-minute serving capacity tests and calf-output. In excess of 182 Brahman, 22 -5/8 Brahman, 523 Santa Gertrudis and 335 Belmont Red bulls from properties in southern, central, western, northern Queensland and the top-end of the Northern Territory were subject to the various fertility measurements.

A sub-group of the bulls was mated in multiple-sire groups and the subsequent calves were identified to their sires using DNA fingerprinting. Ninety-eight percent (98%) of calves born as a result of the multiple sire matings were identified against sires using the DNA fingerprinting of bulls and progeny alone.

The key findings of the project were as follows. Within 3-5 month mating periods in the north, the majority (65%) of tropically adapted bulls available for sale produce fewer calves and have lesser affects on the turn-off animals to satisfy market specifications. Of the bulls mated, 58% of the bulls sired less than 10% of the calves, 13% of the bulls sired greater than 30% of the calves within the mating groups and 7% of bulls sired no calves. The percentage of calves sired (by individual bulls) varied greatly between bulls within mating groups and was moderately repeatable between years.

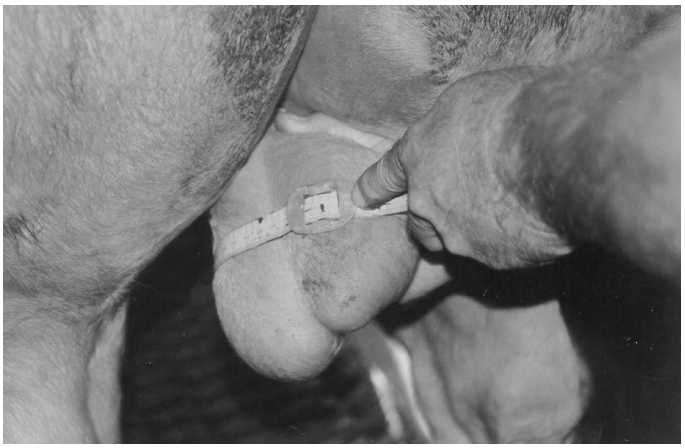

Figure 1. Scrotal circumference measurement

Scrotal circumference should be measured as part of the systematic physical examination of a bull during the Bull Breeding Soundness Examination (BBSE). Scrotal circumference measurement (Figure 1) is moderately to highly repeatable. Across breeds, body weight of the bulls was positively related to scrotal circumference. Scrotal circumference was related to the bull's calf-getting ability in at least one mating group.

Aspects of semen quality influence fertility and calf-output. Semen should routinely be examined as part of the bull breeding soundness examination in *Bos indicus* and *Bos indicus* derived bulls. When examining semen, the percent of morphologically normal sperm should always be determined. Percent normal sperm (as shown in Figure 2) is a trait that is moderately to highly repeatable when measured in bulls in their home environment. Bulls with less than 50% normal sperm usually sire few calves. The percent normal spermatozoa in the semen has been shown to be significantly more predictive of calf-output than the % motile sperm. There is a trend for bulls with larger scrotal circumference to have greater % normal spermatozoa, but this does not apply for all bulls as shown in Figure 3. The percentage of live spermatozoa was not a repeatable test under field conditions.

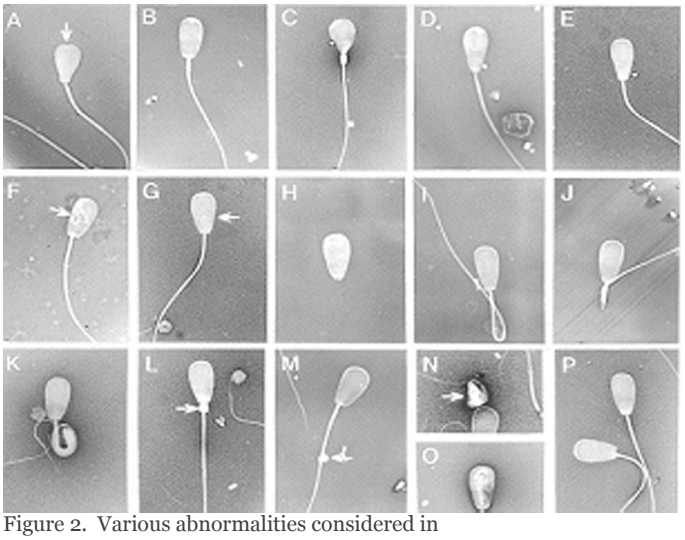

Figure 2. Various abnormalities considered in semen examination

Brahman, 5/8 Brahman, Santa Gertrudis and Belmont Red bulls will exhibit under close supervision in a yard in a serving capacity test. However, their expression of serving capacity is lower than that recorded for British bred bulls. Measures of sexual behaviours (including interest, mounts and serves) did not consistently predict the variation in calf output in extensive mating systems. Serving capacity (Figure 4) continues to be a beneficial tool in determining whether a bull is capable of serving the female. In virgin Santa Gertrudis bulls, prior sexual experience is beneficial in improving the bull's performance in subsequent serving capacity tests. The use of restrained females in the test enhances the ability to identify clinical problems in the bull at the time of examination.

In Santa Gertrudis bulls, those animals with a large umbilicus tended to have a more pendulous prepuce (Figure 5) and achieve fewer mounts and serves in the serving capacity test. The combination of a thickened umbilical cord and enlarged 'rosette' may result in a mechanical interference in serving ability.

Heparin Binding Protein (HBP) profiles have suggested as being directly related to the fertility of the bull. Our results show no relationship between HBP and calf output. 93% of bulls examined (n=73) had HBP profiles of A or B ie the recommended profile.

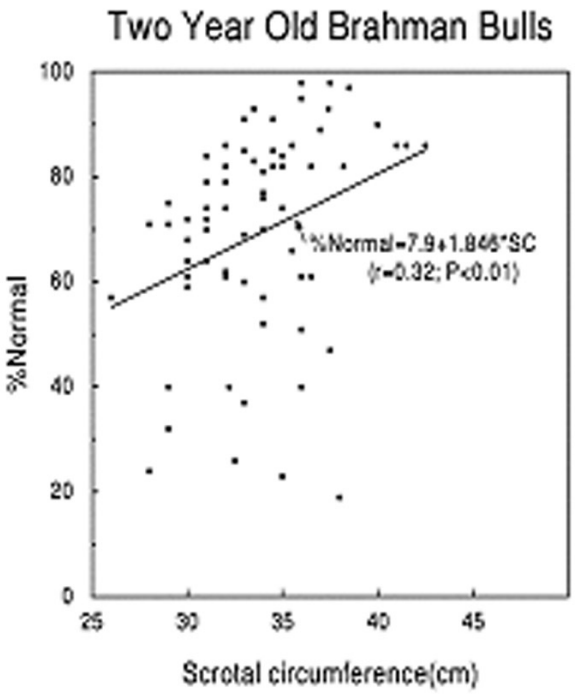

Figure 3. Percentage Normal spermatozoa relative to scrotal circumference

Conclusions

There is no single trait or group of traits that can be measured in an individual bull that will predict the number of calves that a bull will sire. Such is the complexity of factors affecting the ultimate fertility of bulls measured pre-sale and subsequently multiple-sire mated under extensive conditions. There is still substantial unexplained variation between bulls in calf output.

At two sites where dominance hierarchy was clearly established (both were groups of older mixed age bulls of satisfactory semen quality) the dominant bulls sired more calves. In other groups the genuine hierarchy was unable to be assessed.

The results of this work have shown that bull percentages can be reduced to about 2.5% without jeopardising branding rates provided bulls are subjected to a satisfactory breeding soundness examination. This may need to be further qualified under different environmental / geographic conditions.

Figure 4. Serving capacity test conducted with restrained oestrus females

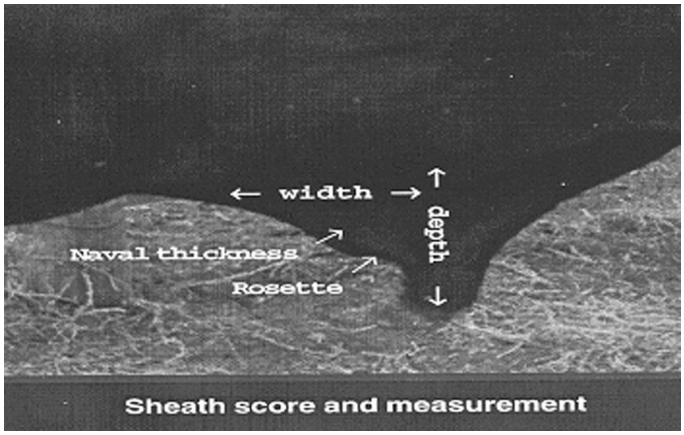

Figure 5. The measurements of the sheath/ prepuce, ulbilicus/navel thickness