SPERM PRODUCTION RATES IN *BOS INDICUS* STRAIN BULLS

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MATERIALS AND METHODS

Testes were collected at castration or at slaughter from purebred Brahman (B); Brahman cross (BX - half and three quarter); Sahiwal cross (SX - three quarter and seven eighths); and purebred and three quarter Santa Gertrudis (SG) bulls of known ages between 19 and 27 months and drawn from herds in northern

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coastal Queensland. Material was also examined from a group of Hereford (H) bulls (18-36 months) as a check on the techniques used, but these data were not included in the analyses since accurate ages were not available.

SPG was determined in all samples by testicular homogenization techniques (Amann and Almquist 1962). In additional samples taken from a random selection of BX and SX bulls SPG was also determined by quantitative histological techniques (Swierstra 1966). Estimates of TSP were derived by multiplying SPG x 0.99 (total testicular parenchymal weight) (Swierstra 1966).

The initial least squares model for analyses included grades within breeds and a covariate of age at castration (or slaughter). As there were no significant grade within breed effects, the final model involved breed comparisons with a covariate for age.

RESULTS AND DISCUSSION

Testes from 197 bulls were examined, comprising material from 162 *Bos indicus* bulls and 35 H bulls. Data from 20 BX bulls (33 percent) and 8 SG bulls (12 percent) were excluded from the analyses since these bulls were judged to have testicular hypoplasia (bilateral and unilateral) or were developmentally immature. The criterion for rejection of data was based on small testis size (<60 g) combined with either very low estimates of SPG or in some cases complete absence of spermatids in testicular homogenates.

Estimates of SPG in the four *Bos indicus* genotypes were very similar (Table 4) but tended to be lower than for the tropical H bulls examined here, and lower than those recorded previously from a range of *Bos taurus* genotypes (Amann 1970). However the estimates were similar to those of 48.9×10^6 recorded for 15-17 month Friesian bulls in New Zealand (Macmillan *et al*. 1972). Preliminary data from older (3-4 yr) *Bos indicus* bulls suggest however that SPG is of a similar magnitude to that found in the present study and thus these differences may reflect inherent genetic variations between *Bos indicus* and *Bos taurus* bulls, rather than being a reflection of the slower maturity of *Bos indicus* bulls.

There were significant breed differences in TSP reflecting the relatively smaller testicular size of B and BX bulls. Similar findings have been reported in respect to testicular size in young (six months) BX bulls (Endo *et al*. 1978). However while in that study BX and SX testis sizes were similar, SX bulls in the present study had significantly greater testis weights and hence greater TSP. In all *Bos indicus* genotypes examined TSP was much lower than for tropical H bulls and for published estimates from *Bos taurus* strains.

Estimates derived from either homogenization or histological techniques were very similar (SPG, $r = 0.966$; TSP, $r = 0.958$), but for large scale investigations, the homogenization technique is more appropriate because of its rapidity, simplicity and cost.

The lower SPG recorded here combined with lower estimates of TSP due to a relatively smaller testis size appear consistent with the suggestion of lower fertility of *Bos indicus* bulls (Seebeck 1973). These findings suggest that selection on the basis of testis size may be a valid criterion for selection for high fertility in *Bos indicus* strain bulls, and this aspect is currently being examined.

TABLE 4 Testis weight, testis sperm concentration (SPG) and testis sperm production (TSP) potential in *Bos indicus* bulls

			Least squares means (±SE) corrected for age		
Genotype	(n)	Mean age (d)	Paired testis parenchymal weight (g)	SPG (x 10^6)	TSP (x 10^9)
B	(16)	680	$235.8^{a\dagger}$ ±15.8	49.66^a ±0.80	11.71^a ±0.56
BX	(40)	605	224.5^a ±12.7	52.48^a ±0.46	11.78^a ±0.32
SX	(21)	584	335.9^b ±21.5	52.21^a ±0.76	17.53^b ±0.89
SG	(57)	581	327.2^b ±17.4	51.99^a ±0.59	17.01^b ±0.72
H	(35)	Range 1.5-3.0 yr	465.2 ±26.5	56.63 ±0.52	26.34 ±0.92
Bos taurus (derived from Amann 1970)		1-12 yr	370-681	56-63	21.4-40.4

† Means in the same column with different superscripts differ significantly (P<0.05).

SUMMARY AND CONCLUSIONS

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The superior reproductive performance of AX cows and bulls reported previously and confirmed in the paper by Seifert *et al*. in this series, was not reflected in an earlier age or lower live weight at puberty in females of this line. Similarly males of this genotype did not reach puberty at an earlier age. Conversely the lower fertility of BX lines found at "Belmont" was not associated with any demonstrable differences in either age or weight at puberty in females or age at puberty of males of this line. In fact, despite the occurrence of drought conditions which delayed onset of puberty in heifers, the small number of grade Brahmans in the study had the lowest age at puberty which is at variance with published data suggesting slow maturity and a greater age at puberty in this genotype. Thus time of onset of puberty, a component of the overall fertility complex in both the male and female, appears unlikely to be a contributing factor to the differences in reproductive performance of a number of *Bos indicus* and *Bos taurus* genotypes in northern Australia.

A high repeatability for fertility in *Bos indicus* lines has been previously suggested (Rudder and Seifert 1977) and was confirmed in the present study of AX and BX lines and their reciprocal crosses. On the basis of these data rigid selection for fertility in cow herds could be expected to lead to phenotypic improvements in herd fertility. Breed variations in bull fertility confirm previous observations and highlight the need to develop selection methods for high fertility particularly in BX bulls.

In the north Queensland environment conception rates, calving rates and weaning rates were comparable in F_1 Sahiwal-Shorthorn and F_1 Brahman-Shorthorn cows although higher overall losses between confirmed pregnancy and weaning were found in Sahiwal-Shorthorn crosses. In these lines age trends in fertility were similar to those reported previously, lowest fertility occurring in cows during their first lactation. Work currently in progress designed to examine the fertility of F_2 and subsequent generations in the Sahiwal will provide objective data for assessment of the possible role of this genotype in the northern beef industry.

A number of variables including body condition, live weight and liveweight change were useful as predictors of pregnancy rate in a *Bos indicus* herd. Within age-lactation groups mean body condition during mating was as good as or better than mean live weight in predicting pregnancy rate. However when cows vary greatly in mature size, live weight may be less important than some measure of body composition, e.g. fat content, but condition scores are not sufficiently accurate to determine this.

Live weight had a curvilinear effect on fertility in heifers and in lactating mature cows, and there was a trend to lower fertility in cows on their first lactation. Weight change was correlated with pregnancy rate but this effect was only significant in mature cows.

Lower estimates of sperm concentration per gram and lower estimates of testis sperm production potential, the latter due in part to smaller testis size, were found in a range of *Bos indicus* genotypes. These findings appear consistent with other reports of lower fertility in *Bos indicus* bulls since testis size is related to fertility at least in *Bos taurus* bulls and selection on the basis of testis size may be a possible criterion for selection for fertility in *Bos indicus* bulls.

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