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 age was not available.

SPG was determined in all samples by texticular homogenization techniques (Manun and Aalquist 1972). In additional samples taken from a random selection of Sx 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 as a gestation (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 117 bulls were examined, comprising material from 162 Box indigo bulls and 35 N bulls. Data from 20 Sx bulls (33 percent) and 5 SX bulls (12 percent) were excluded from the analyses since these bulls were judged to have texticular hypoplasia (bilateral and unilateral) or were developmentally immature. The criterion for rejection of data was based on small testis size (<60 ml) 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 Box indigo 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 Box tahoua genotypes (Manun 1970). However, the estimates were similar to those of 26.7 ± 1.5 recorded for 15-17 month Friesian bulls in New Zealand (Macmillan et al. 1972). Preliminary data from older (>4 yr) Box indigo 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 Box indigo and Box tahoua bulls, rather than being a reflection of the slower maturity of Box indigo bulls.

These were significant breed differences in TSP reflecting the relatively smaller testicular size of S and SX bulls. Similar findings have been reported in respect to testicular size in young (six months) SX bulls (Sparks et al. 1970). However, while in that study SX and SX testis sizes were similar, SX bulls in the present study had significantly greater testis weights and hence greater TSP. In all Box indigo genotype examined TSP was much lower than for tropical H bulls and for published estimates from Box tahoua strains.

Estimates derived from either homogenization or histological techniques were very similar ('SPG, p = 0.986; TSP, p = 0.955.', 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 Box indigo bulls. This would suggest that selection on the basis of testis size may be a valid criterion for selection for high fertility in Box indigo strain bulls, and this aspect is currently being examined.
<table>
<thead>
<tr>
<th>Genotype</th>
<th>Mean age (d)</th>
<th>Patted testis primochal weight (g)</th>
<th>SSC (x 10^5)</th>
<th>TSP (x 10^5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B (40)</td>
<td>680</td>
<td>231.8 ± 7^b</td>
<td>49.66 ± 4^a</td>
<td>11.71 ± 8^a</td>
</tr>
<tr>
<td>BX (40)</td>
<td>605</td>
<td>226.4 ± 7^b</td>
<td>54.49 ± 4^a</td>
<td>11.78 ± 8^a</td>
</tr>
<tr>
<td>SX (23)</td>
<td>584</td>
<td>335.9 ± 7^b</td>
<td>52.21 ± 4^a</td>
<td>17.55 ± 8^a</td>
</tr>
<tr>
<td>SG (57)</td>
<td>581</td>
<td>337.7 ± 7^b</td>
<td>51.95 ± 4^a</td>
<td>13.01 ± 8^a</td>
</tr>
<tr>
<td>N (35)</td>
<td>Range 1.5-3.0 yr</td>
<td>465.2 ± 7^b</td>
<td>56.63 ± 4^a</td>
<td>26.34 ± 8^a</td>
</tr>
</tbody>
</table>

| Bos taurus | (derived from Amann (1970)) | 1-12 yr | 370-481 | 16-63 | 21.4-40.4 |

^ Means in the same colour with different superscripts differ significantly (P<0.05).

SUMMARY AND CONCLUSIONS

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 AX lines found at "Salmon," 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 brumsans in the study had the lowest age at puberty which is at variance with published data suggesting slow maturation and a greater age at puberty in this genotype. Thus time of onset of puberty, a component of the overall fertility complex is both the same in heifers and females, appears unlikely to be a contributing factor to the difference 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 bulls could be expected to lead to phenotypic improvements in herd fertility. Bread 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 F1, Sahali-Shorthorn and F2 Brahman-Shorthorn
cows although higher overall losses between confirmed pregnancy and weaning were
found in Sahali-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 fertili-
ity of F2 and subsequent generations in the Sahali 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 Box index 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 sperm and lower estimates of
testis sperm production potential, the latter due in part to smaller testis size,
were found in a range of Box index genotypes. These findings appear consistent
with other reports of lower fertility in Box index bulls since testis size is
related to fertility at least in Box taurus bulls and selection on the basis of
testis size may be a possible criterion for selection for fertility in Box
index bulls.

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