BREEDING STRATEGIES FOR BEEF CATTLE IN THE SUBTROPICS
AND TROPICS: TERMINAL CROSSBREEDING

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SUMMARY

The only breeding strategies to be followed in tropical and subtropical areas appears to be pure breeding with indigenous breeds in the harsh and undeveloped areas and terminal crossbreeding in the more developed areas. Evidence is presented that terminal crossbreeding is highly advantageous and increases efficiency of animal production.

INTRODUCTION

Almost half of the world's rangelands and domestic animals are found between the environmental bounds of the subtropics and tropics (Heady, 1984). Much of the world's subtropics and tropics are in developing countries where cattle are largely owned by subsistence farmers (Leng & Brumby, 1986). Almost 80% of the cattle in developing countries are in the subtropics and tropics.

The level of nutrition in large parts of Africa is such that it simply cannot provide for the higher demands of exotic breeds or their crossbreds (Scholtz, 1988). Hofmeyr (1974) is of the opinion that the standard of husbandry and management and the attitude of many cattle owners is such that productivity is often low, and little or no increase in production is possible through the introduction of potentially more productive breeds until these traditional methods of husbandry have been changed. Imports of meat and milk into Africa was close to $US 5 billion per year in 1979 (Leng & Brumby, 1986).

All the cattle breeds of Africa, even when kept under optimal managerial conditions, are fairly small, probably indicating that the environment is such that it cannot support larger animals. Taylor & Murray (1987) indicated that under conditions of food shortage small breeds have an advantage over larger breeds. Small breeds also have a higher relative organic matter intake under conditions of food shortage due to the allometric relationship between size and incisor breadth (Illius, 1989). It would thus be unwise to select for growth rate or body mass above a certain optimum level, which might result in animals unadapted to the prevailing conditions.

BREEDING STRATEGIES

The type of breeding strategy to be followed in the subtropics and tropics of Africa will primarily depend on the environment and level of management.

Pure Breeding

In harsh and undeveloped or communal areas pure breeding with indigenous breeds is the only breeding strategy to be followed. The level of nutrition in these areas is such that it cannot provide for the higher demands of exotic breeds or their crossbreds. If indigenous breeds are not adapted for production in a particular area it may be sensible to consider the formation of a synthetic breed by crossing a number of indigenous breeds (Hofmeyr, 1974).
Any effort to improve beef production should be strongly directed towards the improvement of management and nutrition, and the education of people. The introduction of exotic breeds alone will not solve the problem.

Crossbreeding

Experimental evidence on the fertility of crossbred cows was summarized by Long (1980). He found, with few exceptions, that the fertility and calf viability of crossbred cows were higher than that of the best parental breed. This is not the situation in East and Southern Africa under normal production conditions (Hetzel, 1988; Scholtz, 1988).

From Thompson et al. (1986) it seems that a high level of nutrition and management is needed before the potentially higher fertility of crossbred cows can be utilized. With the relative low level of nutrition and management that prevails in Africa, it seems fruitless to try to improve maternal performance via crossbreeding. Furthermore, the continuous production of crossbred cows requires large managerial inputs.

Terminal Crossbreeding

In the more developed areas, where the managerial skills are better, but where conditions may often still be harsh with relatively low levels of nutrition, terminal crossbreeding with small cows may succeed in improving the output from beef cattle farming. In general, any system producing large offspring for slaughter from small dams will be more efficient than systems with both large mothers and offspring or small mothers and offspring. The gain in feed efficiency can be attributed to the lower feed intake of the smaller dam.

Terminal crossbreeding, in contrast to rotational systems of crossbreeding, does not put any burden on managerial skills. It simply implies that bulls from the sire and dam lines are mated in the desired ratio to the cows and that all crossbred progeny are marketed.

Due to their adaptation, hardiness and disease resistance indigenous breeds should be utilized as dam lines (Hofmeyr, 1974). The potential of the Nguni (indigenous to the east coast of Southern Africa eg. Swaziland, Zululand, Mozambique and Zimbabwe) as a dam line in terminal crossbreeding is being investigated and preliminary results are presented here.

INVESTIGATION

Material and Results

Nguni females (smallest breed in South Africa) were inseminated with Charolais semen (largest breed). Traits evaluated were birth mass (B-mass), weaning mass (W-mass), yearling mass (Y-mass) and growth rate (ADG) under extensive conditions as well as final mass (F-mass), growth rate (ADG) and feed conversion ratio (FCR) under intensive feedlot conditions as evaluated by the South African Performance Testing Scheme, which comprises of a 140-day test preceded by a 35-day adaptation period.

Only one Charolais bull was used and the crossbreds (CN) were compared to their purebred halfsib Charolais (C-hs) as well as to Ngunis (N) (purebred but not halfsib) from the same origin and herd. The information on the
performance of the C-hs under extensive conditions was obtained from Els (1988). In addition, the results of this experiment were related to the average performance of a number of breeds in South Africa namely the Nguni, Charolais, Afrikaner, Shorthorn, Bonsmara, Simmentaler and Brahman. All the relevant information is presented in Table 1.

Table 1  Performance of the experiment and breed averages (mass in kg; growth rate in g)

<table>
<thead>
<tr>
<th>Trait</th>
<th>Experimental (n)</th>
<th>Breed averages (performance testing 1976-1985)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>CN</td>
</tr>
<tr>
<td>Extensive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-Mass</td>
<td>27</td>
<td>34</td>
</tr>
<tr>
<td>W-Mass</td>
<td>179</td>
<td>205</td>
</tr>
<tr>
<td>d</td>
<td>193</td>
<td>232</td>
</tr>
<tr>
<td>X</td>
<td>186</td>
<td>219</td>
</tr>
<tr>
<td>ADG B-W</td>
<td>775</td>
<td>900</td>
</tr>
<tr>
<td>Y-Mass</td>
<td>182</td>
<td>204</td>
</tr>
<tr>
<td>d</td>
<td>211</td>
<td>252</td>
</tr>
<tr>
<td>Feedlot (d')</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-Mass</td>
<td>353</td>
<td>486</td>
</tr>
<tr>
<td>ADG</td>
<td>1121</td>
<td>1652</td>
</tr>
<tr>
<td>FCR</td>
<td>7,46</td>
<td>6,36</td>
</tr>
</tbody>
</table>

CN vs N: All differences significant at 1%
CN vs C: Only B-mass and F-mass significantly different (1%)

DISCUSSION

Although the numbers are small, and the results may therefore be of preliminary significance, general tendencies could be identified.

It is a question of considerable importance whether fetal dystocia can be avoided in terminal crossbreeding by a strong maternal limitation on fetal size, curtailing the genetic effect of the sire breed at birth, while allowing adequate expression of the genetic growth potential later in life. No calving difficulties or perinatal deaths were found for the 23 CN calves. If a 10% chance of calving difficulty or death exists, the probability of observing one or more cases from a sample of 23 would be 100 (1-0,923) = 91%. Therefore, with a considerable probability of birth problems, there would be a high chance of observing them from 23 births.

The N calves had a birth mass of 27±0,3 kg and the CN calves an average of 34±0,6 kg. Els (1988) recorded an average birth mass of 47±0,9 kg for the C-hs. The Nguni cows, therefore, restricted the birth mass of the crossbred calves well below the mid-parent value of 37 kg. This, together with the results of Gregory et al. (1978) is an indication that maternal restriction of offspring birth size may be evident if the difference between sire and dam breeds is large enough. While the birth mass of CN was 8% below the mid-parent value, the weaning mass was 7% above, and the preweaning growth rate 10% above the mid-parent value.

Under extensive conditions the yearling mass of CN was 19% higher than that of N. Under intensive conditions the F-mass was 38% higher and ADG 47% higher than that of N. This indicates the presence of genotype x environmental interaction. FCR was 3% better than that of the best parent.
The feedlot performance of C-hs is almost identical to that of the Charolais breed average, indicating that the bull used was representative of the breed. This validates the conclusion despite the small numbers involved. The growth rate of CN is similar to that of the purebred Simmental and is only about 6% lower than that of the purebred Charolais under intensive feedlot conditions, whereas the FCR is respectively 10% and 5% better. The feedlot performance of CN seems to be highly desirable and exceeds that of popular breeds such as the Bonsmara and Brahman.

The Bonsmara is a composite developed from crosses between the Afrikaner and exotic breeds (largely the Shorthorn). In Table 1 the FCR of the Bonsmara is better than either of the two parent breeds, which is similar to the FCR of the CN being better than the best parent. It seems, therefore, that FCR may be notably increased when Sanga cattle (indigenous to Africa) are crossed with European Taurus breeds.

CONCLUSION

Indigenous cattle breeds such as the Nguni seem to be ideally suited as dam lines in terminal crossbreeding, since calving difficulties are limited and the feedlot performance of the F1-crosses is highly desirable. An increase in total herd efficiency can be expected due to the lower intake of the smaller dam which produces large offspring for slaughter. The utilization of terminal crossbreeding involving the indigenous breeds of Africa deserves more attention as a means of increasing the output from beef cattle enterprises in the subtropics and tropics. The export of breeds from Africa to other tropical and subtropical areas may be advantageous.

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REFERENCE