A COMPUTER MODEL OF A SELF-REPLACING BEEF HERD

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SUMMARY

The effects of calving time and stocking rate of a self-replacing Hereford herd in western Victoria were simulated. Pregnancy rates, weaner weights, supplements required and gross margins per hectare were calculated. Gross margins were highest for winter and lowest for autumn calving and were maximum at about 1.25 cows per hectare.

INTRODUCTION

Calving date has not been adequately investigated in beef production systems because interactions between calving date, stocking rates, marketing, years, etc. make such investigations unfeasible. Therefore we have attempted an analysis by modelling and simulating a beef production system.

THE MODEL AND EXPERIMENTAL DESIGN

The model, shown in Fig. 1, was driven by 16 years of meteorological data from Hamilton, Victoria. The general methods followed those of White (1982) and others at the 1982 conference. The pasture model followed that of Bowman et al. (1982). Three calving dates and seven stocking rates (SR) were simulated (Table 1). Summer calving was prompted by favourable reports (D. Hamilton pers. comm.) in north eastern Victoria. Autumn calving with vealer production is widespread in Victoria. Winter calving seemed likely to increase utilisation of pasture and offer more stability than other systems provided steers were marketed at about 15 months old. Surplus heifers were sold after pregnancy diagnosis, 20 per cent being retained as replacements. Cows were sold when ten years old. In the winter system steers were run at 2.0 per hectare, cows being restricted to the remaining area according to numbers of steers. Animals were divided into classes according to age, physiological status, sex, conception and calving date, and selling policies of each group were those which appeared most appropriate for the production system. Pregnancy rates were estimated from age and live weight in heifers (Axelsen and Morley 1976), and from live weight and liveweight change in cows (Morley et al. 1976).

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Management of the different systems simulated</th>
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</thead>
<tbody>
<tr>
<td>Calving period:</td>
<td>Autumn</td>
</tr>
<tr>
<td>joining start</td>
<td>3 June</td>
</tr>
<tr>
<td>calving start</td>
<td>11 March</td>
</tr>
<tr>
<td>weaning date</td>
<td>7 January</td>
</tr>
<tr>
<td>sales:</td>
<td>9-10 month weaners</td>
</tr>
<tr>
<td>: date</td>
<td>7 January</td>
</tr>
<tr>
<td>: price (kg)</td>
<td>71¢</td>
</tr>
<tr>
<td>S.R. (all systems):</td>
<td>0.5, 0.75, 1.0, 1.25, 1.5, 1.75 and 2.0 cows/ha</td>
</tr>
</tbody>
</table>

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Daily updating may be preferable but costly.

Data from Meteorological Bureau.
Climate generator could be used.


Upper intake limit is a function of age and potential weight. Actual intake adjusted for availability and digestibility of green and dead pools; physiological status, old age and obesity. Milk production according to Wood (1967) adjusted for condition and energy balance. Transition from non-ruminant to ruminant as in White et al. (1983). Supplement (wheat:weaners; hay: other classes) if below critical weight specified.

Calculate metabolizable energy (ME); allocate first to maintenance and pregnancy. Partition surplus between lactation and growth. Energy requirements and efficiency of utilization of ME after ARC (1980).

Calculate gains or losses according to energy content of the body and energy balance (ARC 1980).

Death rates calculated from values specified for each class of stock.

Fig. 1. Simplified flowchart of model
The most significant results, summarized in Fig. 2, show that 1) the optimum SR was about 1.25 cows per hectare for winter calving, perhaps slightly higher for the other times; 2) the maximum gross margin was about $25 and $35 per hectare higher for winter than for summer or autumn calving respectively; 3) increased SR caused a curvilinear decline in pregnancy rates (PR) and a linear decline in weaner and steer live weights, but an exponential increase in requirements for supplements.

Fig. 2, Response of pregnancy rate (a), gross margin/ha (b), weaning and steer weights (c), and supplement required (d) to stocking rate and date of calving.

Averages of 16 years run (1965 - 1980)

Prices and costs: Prices obtained vary monthly. Interest 12.5% on $300/cow; hay $150/t; wheat (weaners only) $150/t; selling costs 6.50%; health $2-3/animal.
DISCUSSION

The predictions seem generally consistent with results of Axelsen et al. (1972), Bailey (1971) and Cummins (1979) on the effects of calving time, and the effects of SR as discussed by Morley (1981). The response of weaning weights to SR was greater for the winter system, but the final weight of the steers did not show this trend because steers were always stocked at two per hectare regardless of the SR of the cows. Compensatory growth also had some effect.

The advantage of winter calving in terms of gross margin, at a wide range of SR, seems to depend only slightly on pregnancy rates, but must depend heavily on having the highest grazing pressure in the spring when pasture growth rates and availability are maximum, and also on the fact that more of the pasture is consumed at this time by animals being prepared for market than by breeding stock. In addition the system would confer some flexibility in unfavourable seasons through marketing steers early, perhaps for feed-lotting, while preserving the breeding herd intact. If the season were unusually favourable they could be held to heavier weights, provided price penalties were not severe.

These results suggest that many of the existing beef production systems in Victoria could be improved by a change to later calving systems. Although it might be wise to wait until such modified systems are explored on the ground, the likelihood that this will be done with sufficient precision, in the next few years, is probably so low that a beef producer might well be advised to make the change immediately, at least on a pilot scale.

REFERENCES


