THE PRODUCTIVITY OF CROSSBRED AND STRAIGHTBRED COWS WHEN GRAZED SEPARATELY AT THREE STOCKING RATES

I.H.L. MORGAN, A. J. CLARK and J.F. GRAHAM
Dept of Food and Agriculture, Pastoral and Veterinary Institute, PB 105, Hamilton, Vic. 3300.

SUMMARY
Hereford (HH), Angus x Hereford (AH) and Friesian x Hereford (FH) cows were grazed separately at low, medium and high stocking rates over 4 years and mated to Hereford bulls. Stocking rate relationships were developed for weaning weight, pregnancy rates, weaning weight per hectare and profit per hectare. The results demonstrated the economic value of using crossbred cows and provided strong evidence of genotype by stocking rate interactions. The FH cows were the most productive and most profitable at the low stocking rate and the AH cows at the high stocking rate.

Keywords: crossbred cows, stocking rate, profit/hectare.

INTRODUCTION
When grazing together, most types of crossbred cows produce heavier and more weaners than straightbred, traditional British breed cows (Barlow and O'Neill 1978; Long 1980; Baker et al. 1981; Morgan and Clark 1982). However, both pen feeding studies and estimates of the pasture intake of grazing cows have shown that the more productive genotypes invariably have a higher feed intake during lactation and, in some instances, when non-lactating (Ferrell and Jenkins 1984; Wagner et al. 1986; Barlow et al. 1988).

Assessments of the relative feed efficiency of cows or herds of different breed types are complex; whilst recent studies do not indicate clear and consistent differences, they do show a tendency for beneficial effects from hybrid vigour and for British and Zebu cows to have lower maintenance requirements per kg liveweight and higher feed efficiency than European and dairy breeds (Jenkins et al. 1991; Green et al. 1991; Reid et al. 1991). Under our management system (year-round grazing with little supplementation) the relative production and profit per hectare of different cow genotypes when grazed separately over an appropriate range of stocking rates represents a more commercial and, potentially, a more reliable evaluation of productivity or ‘efficiency’. Deland et al. (1990) used a similar approach but mated his crossbred cows to Charolais sires.

MATERIALS AND METHODS
The cows used in this experiment were obtained in 2 ways: (i) about half of them were bred at the Pastoral Research Institute from Hereford dams which had been purchased from several herds in the area; these purchased dams were inseminated at random during 1980 and 1981 with semen from 20 Hereford, 18 Angus and 25 Friesian bulls which was commercially available from bulls bred in Australia and New Zealand, (ii) to replace females lost by fire in 1983, Hereford, Angus x Hereford and bucket-reared Hereford x Friesian heifers were purchased from several properties in Victoria.

The experimental design of this experiment consisted of 3 cow genotypes, Hereford (HH), Angus x Hereford (AH), and Friesian x Hereford (FH) grazed separately at 3 stocking rates in 2 replicates. In 1985 the low, medium and high stocking rates were 1.0, 1.4 and 1.8 cows/ha with 20 cows per treatment or 10 per plot; during 1986, 1987 and 1988 the stocking rates were 0.9, 1.26 and 1.62 cows/ha with 18 cows per treatment or 9 per plot. These genotypes were chosen because: (i) the Hereford is the most numerous breed in Victoria and an obvious ‘control’; (ii) Angus and Friesian crosses with Hereford have been shown to be highly productive; (iii) they are of similar size but produce different amounts of milk.

The pasture was renovated in 1983 and was composed mainly of perennial ryegrass, phalaris, subterranean clover and smaller proportions of other grasses and clovers. Hay feeding was initiated during autumn if some cows were considered in danger of dying. In 1985 the hay was fed in relation to stocking rate as follows: 3 19 kg/cow at 1.0 cows/ha, 254 kg/cow at 1.4 cows/ha and 214 kg/cow at 1.8 cows/ha. This was an attempt to maintain the relationship between stocking rates but this approach was subsequently abandoned because of cost and apparent wastage. During 1986, 1987 and 1988 all cows were fed 50-140 kg of hay as a ‘bull allowance’ during mating because the bulls increased grazing pressure. In addition, in 1988 all the cows stocked at 1.62/ha and at 1.26/ha were fed 430 and 140 kg of hay, respectively. The 3 breed types were always fed the same amounts.

Cows and calves were set-stocked except during the 9-week mating period, from 1 June, when the
cattle from replicate plots of the same treatment were combined for mating and alternated weekly across the 2 replicates. Bulls were rotated weekly across breeds and stocking rates. Pregnant cows, aged 2 and 3 years, with calves at foot were allocated to the plots in November 1984: the first calving during March-April 1985 represented the first experimental results. Any cow not suckling a calf was replaced by a cow/calf unit from a ‘spare group’ which consisted of cows of the 3 genotypes grazed together at 2 intermediate stocking rates of approximately 1.1 and 1.5/ha; the former provided spares for the low and medium stocking rate plots and the latter provided spares for the medium and high stocking rate plots. Non-pregnant cows were replaced by pregnant spares at weaning.

Because of the limited degree of replication and to avoid any genotype being favoured over the 4 years of the experiment by plot differences in pasture productivity, genotypes within stocking rates and replicates were rotated on an annual basis at weaning. Pregnancy rates were assessed by rectal palpation in early and late pregnancy and confirmed by calving observations. Calves were weaned in early January and valued by Department of Agriculture Livestock Market Reporters. Fasted weaning weights were calculated by using unweighted means of steers and heifers from each treatment because of uneven sex ratios. Linear regressions between stocking rate and the productive traits, weaning weight and pregnancy rate, were analysed using GENSTAT 5. The curvilinear relationships between stocking rate and weaning weight per hectare were calculated from the linear regressions. Weaned liveweight per hectare (WLH) was calculated on the basis that each cow weaned a calf as was determined by the experimental protocol. Weaned liveweight per hectare (with pregnancy rate) was calculated by multiplying WLH with pregnancy rate.

![Graphs showing relationship between stocking rate and weaning weight, pregnancy rate, and weaned liveweight per hectare](image)

**Fig. 1.** Relationship between cow stocking rate and (a) weaning weight; (b) weaned liveweight weight per hectare; (c) pregnancy rate; (d) weaned liveweight per hectare (with pregnancy rate). Each point represents the mean of two replicates per year amounting to a total of 12 points per breed (HH, AH, FH). The equations of the lines are:

- (a) fasted weaning weight
  - $y = 358.3 - 78.6x$ ($r^2 = 0.66$, r.s.d. = 17.7)
  - $y = 342.8 - 43.2x$ ($r^2 = 0.63$, r.s.d. = 10.4)
  - $y = 426.4 - 96.0x$ ($r^2 = 0.90$, r.s.d. = 10.4)

- (c) pregnancy rates
  - $y = 106.8 - 11.6x$ ($r^2 = 0.09$, r.s.d. = 8.6)
  - $y = 107.1 - 10.0x$ ($r^2 = 0.03$, r.s.d. = 9.4)
  - $y = 144.1 - 47.9x$ ($r^2 = 0.47$, r.s.d. = 15.6)
RESULTS

The decline in weaning weight as stocking rate increased was less severe for calves born to and suckled by AH cows than for calves from HH and FH cows (Fig. 1a). Pregnancy rate appeared to decline more sharply in FH cows than in HH and AH cows as stocking rates increased but none of these relationships were significant (P > 0.05, Fig. 1c). Pregnancy rate was almost 100% for all genotypes at the low stocking rate and was much less variable than at the medium and high stocking rates. Weaned liveweight per hectare, with allowance for pregnancy rate, increased in HH and AH cows up to 1.62 cows/ha while that for FH cows did not increase as stocking rate increased (Fig. 1d).

DISCUSSION

The relationship observed between fasted weaning weight and stocking rate for straightbred Hereford cows (Fig. 1a) is similar to that predicted by Morgan et al. (1982) based on the results of Curnmins (1979). The relationship simulated by Späth et al. (1984) also predicted similar weaning weights at a stocking rate of about 1.3 cows/ha but, relative to our data, predicted lower weaning weights at low stocking rates and higher weaning weights at high stocking rates.

The weaning weight by stocking rate relationships observed for AH and FH cows (Fig. 1a) are different to those postulated by Morgan et al. (1982) who assumed constant increases over HH cows of 10 and 20%, respectively, at all stocking rates. At the low stocking rate, weaners from AH cows were only 5% heavier than weaners from HH cows while at the high stocking rate the FH cows did not produce heavier weaners than did the AH cows.

The linear relationship between pregnancy rate and stocking rate in HH cows (Fig. 1c) is 10-15% units of pregnancy rate higher at all stocking rates than the non-linear relationship simulated by Späth et al. (1984) and also higher than that predicted for weaning rate by Morgan et al. (1982). However, the sharp decline in pregnancy rate in FH cows at the high stocking rate is very similar to that predicted by Morgan et al. (1982).

A gross margin analysis using the computer program of W. Holmes, Queensland Department of Primary Industries, showed financial benefits from using AH and FH cows as compared with HH cows; this analysis used the mean results over 4 years and included a 15% interest cost on the initial value of young pregnant cows to allow for the higher investment costs associated with increased stocking rate (Table 1). The highest profits were obtained at the medium stocking rate using self-replacing AH and FH cows; the latter was the most profitable of all systems but needs the following qualifications, (i) a self-replacing FH herd would need to use either criss-cross systems or FH bulls which would probably reduce weaner values as compared with the HH sired weaners produced in the experiment. On the other hand, the FH 'buy' options would allow the use of a large, muscular terminal sire which would increase the value of the progeny; (ii) a poor season or a misjudged nutrition level, particularly after calving, could seriously reduce pregnancy rates as occurred in 2 of the 4 years at the high stocking rate.

The results of this experiment show that for autumn calving herds in southern Victoria, British × British and Dairy × British cows are more productive per hectare than straightbred British cows but that Dairy × British cows are less able to tolerate high grazing pressures or undernutrition.

<table>
<thead>
<tr>
<th>Cow breed/system</th>
<th>Stocking rate (cow s/ha)</th>
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<tbody>
<tr>
<td></td>
<td>0.9</td>
</tr>
<tr>
<td>Hereford SR</td>
<td>128</td>
</tr>
<tr>
<td>Angus × Hereford SR</td>
<td>143</td>
</tr>
<tr>
<td>Friesian × Hereford SR</td>
<td>167</td>
</tr>
<tr>
<td>Friesian × Hereford bought at $500</td>
<td>152</td>
</tr>
<tr>
<td>Friesian × Hereford bought at $600</td>
<td>141</td>
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n.v., not viable due to insufficient replacements.
REFERENCES


