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EFFECT OF CALVING TIME AND STOCKING RATE ON PRODUCTION OF BEEF COWS

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Summary

Stocking rates of 2.16 and 1.08 cows ha^{-1} and calving times of April and August were compared in 1966 and 1967, and stocking rates of 1.85 and 1.24 cows ha-l and calving times of June and August were compared in 1969 and 1970. Low rainfall was recorded in 1967 (67 per cent of the mean). In 1966 and 1967, calving rates were much lower at the higher stocking rate, but were no different in 1969 and 1970. Calf gains to four months of age were higher for August calving, but from four to eight months (when calves were weaned) were higher for April calving. There was little difference between June and August calvings. Weaning weights were higher at low stocking rates, but time of calving treatments reflected seasonal conditions.

The highest gross margins in 1966 and 1967 were obtained at 1.08 cows ha", at either calving date. In the higher rainfall years of 1969 and 1970 gross margins favoured 1.85 cows ha-l calving in June.

I. INTRODUCTION

The evidence available upon which to base decisions on calving times and stocking rates with beef cows in southern Australia is almost negligible. In Victoria, Robinson and Cameron (1960) obtained higher weaning weights from autumn born calves than from spring born calves. Experiments with steers (Vivian 1970), and steers and breeding ewes (Bennett et *al.* 1970; Hamilton and Bath 1970), could give some leads to stocking rates, though the hazards of extrapolating from these are likely to be considerable. Therefore an exploratory trial was commenced in 1965 at Ginniderra Experiment Station, Canberra.

II. MATERIALS AND METHODS

An area of phalaris (*Phalaris tuberosa*) and Bacchus Marsh subterranean clover (*Trifolium subterraneum*) sown in 1959 and including volunteer annual grasses (*Hordeum leporinum, Bromus* spp.) was sub-divided into two paddocks of approximately 10 ha, and four of approximately 5 ha. A total of 1635 kg ha^{-1} of superphosphate was applied up to 1966 when applications ceased.

Aberdeen Angus heifers (aged 18 months) were randomly allocated to treatments in January, 1965. Dates of calving, weaning and **mating** are shown in Table 1. Mating in 1965 was the same as 1966, and in 1968 the same as 1969.

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TABLE 1

Dates of calving, weaning and mating

Year		Treatment	Calving		Weaning		Mating	
			Start	End	Date	Age (months)	Start	End
I	(1966)	Early	17.3.66	27.4.66	6.12.66	8	7. 6.66	18. 7.66
		Late	17.7.66	28.8.66	17.4.67	8	14.10.66	25.11.66
II	(1967)	Early	17.3.67	27.4.67	12.12.67	8	14. 7.67	25. 8.67
		Late	24.7.67	4.9.67	4.1.68 HSR*	5	13.10.67	24.11.67
					4.4.68 LSR	8		
III	(1969)	Early	2.6.69	14.7.69	25.2.70	8	22. 8.69	3.10.69
		Late	4.8.69	11.9.69	27.4.70	8	21.10.69	5.12.69
IV	(1970)	Early	1.6.70	13.7.70	3.3.71	8	20. 8.70	1.10.70
		Late	1.8.70	14.9.70	3.5.71	8	22.10.70	4.12.70

*Due to poor feed conditions, early weaning at the high stocking rates was considered essential for survival. Hand feeding costs attributable to rearing these calves from weaning to eight months was debited against these treatments.

In years I and II, cows were set stocked at 2.16 ha^{-1} on the small paddocks, and 1.08 ha^{-1} on the large paddocks. In 1968 (because of drought) cows were off the area from April 18 to July 10, and stocking rates were changed to 1.85 and 1.24 cows ha^{-1}, so data for this year are not presented. Calving times were also changed for years III and IV (Table 1). Only reproductive records for cows remaining on the paddocks for an entire two-year period are reported. Animals were weighed monthly, and bull calves castrated when one month old. Steers were slaughtered at weaning in all years except 1967. Heifer calves were slaughtered in 1966 only.

Maintenance levels of supplementary feed were required in the winter of 1967 at the higher stocking rate only, and from January to April 1968 for late calves at the higher stocking rate (Table 1).

Annual rainfalls from 1965 to 1970 inclusive were 450, 782, 441, 749, 892 and 802 mm respectively. The mean annual rainfall is 660 mm.

Since variance in production measurements tends to increase with stocking rate (Morley 1966; Morley and Spedding 1968), and resources were limited, only the higher stocking rate was replicated. As the error term derived from these plots is likely to be inflated for comparisons involving the lower stocking rate, the statistical tests are probably conservative.

III. RESULTS

Calving rates from the 1965 mating (before treatments were effective) were all 1.00. In years I and II and stocking at 2.16 cows ha^{-1}, calving rates were about 0.50 (Table 2). The mean weight of early cows at mating (midwinter) was 3 10 kg in both years and cows were losing weight, while late cows at mating (late spring) were 63 and 28 kg heavier in years I and II respectively and gaining weight. However, the late cows were severely affected by the drought in year II (1967), and only 20 per cent of lactating cows and 57 per cent of dry cows were again pregnant. The mean weight of cows at the lower stocking rate in years I and II was 417 kg at mating, and calving rates were higher.

In years III and IV the mean weights of cows at the higher stocking rate ($1.85 ha^{-1}$) were 482 kg for both early and late matings (now early and late spring), and 530 and 564 kg respectively at the lower stocking rate. Calving rates were all above 0.82.

Birth weights of calves were not consistently different, but were generally higher for late calving at the lower stocking rate. In years I and II, April born calves gained more slowly to four months of age ($P < 0.1$), but more rapidly from four to eight months of age ($P < 0.05$), than August born calves. In years III and IV growth rates of June and August born calves were similar. Weaning weights were higher on lower stocking rates, except in years III and IV from June calving (Table 2).

Of four cows that died over 6 years on the experiment, only one could be related to treatment (undernutrition in the late calving at the higher stocking rate in 1967). Some calves died at birth in June and August and the incidence was higher at high stocking rates (mean 12 per cent) than at low stocking rates (mean

TABLE' 2

Calving rates (number of calves ***born/total number*** of *cows*) ***and*** weaning ***weights*** of calves

Calving time	Early		Late		Probability levels for significance				
Stocking rate	High	Low	High	Low	High vs. Low	Early vs. Late	Inter-action	Components Early *vs.* Late (high)	(low)
Years of joining	Calving rates								
I & II (1966-67)	0.54	0.75	0.48	0.89			<.1	<.2	<.1
III & IV (1969-70)	0.82	0.95	0.82	0.85					
Years of calving	Weaning weights (kg) — adjusted to 252 days of age								
I 1966	186	223	186	242	<.1				<.25
II 1967	177	225	140*	196	<.1	<.2			
III 1969	281	279	247	275			<.2	<.2	
IV 1970	251	244	254	296			<.2		<.2

*Weight at 252 days, though weaned at 5 months (Table 1).

3 per cent). In years I and II there were no deaths at the early calving in April.

In 1967, at the higher stocking rate, late cows required a mean supplement of 1.7 kg DOM day^{-1} for 84 days — almost three times as much as was fed to the early cows. No feeding was required at the lower stocking rates. Early weaned late calves at the higher stocking rate were fed 5.1 kg DOM day^{-1} for 91 days (Table 1).

IV. DISCUSSION

For autumn calving, cows had to be mated in midwinter when they were in poor condition, except at low stocking rates or in favourable years. For winter or early spring calving, cows were in better condition at mating and produced more calves. Feeding before and during mating can improve conception rates (Dunn ***et al.*** 1969), even if nutrition has been low before calving (Hight 1968).

Spring feed was usually ample for good calf growth (except in 1967), but calves born in April and June required good winter feed for early growth. Calves born in August grew well to four months of age (in spring), but later performed poorly in the absence of late summer and autumn rains. Thus seasonal conditions interacted with calving time. Calves were acceptable as vealers except at the higher stocking rate in 1967.

A gross margins analysis of the results (Table 3) gave interactions in years I and II between calving time and stocking rate ($P < 0.1$), calving time and years ($P < 0.1$), and stocking rate and years ($P < 0.2$). In years III and IV the only interaction was between calving time and years ($P < 0.2$). A stocking rate of 2.16 cows ha^{-1} was too high. However a stocking rate of 1.85 cows ha^{-1} and calving in June gave the best returns in years of higher rainfall. If the analysis of non-biological factors (price effects, drought costs and risk aversion) of McArthur and Dillon (197 1) is accepted, and these data used, stocking at

1.24 cows ha^{-1} and calving in June would seem the most likely decision for a farmer.

TABLE 3

Gross margins analysis ($\$ha^{-1}$)

Assumptions

1. Carcase value = \$0.66 kg^{-1} for all treatments.
2. Cow costs = \$20 $year^{-1}$.
3. Dressing percentage for heifers the same as steers on the same treatment. Dressing percentages for 1967 the same as 1966 for the same treatment.
   Gross Margin = {Price kg^{-1} × carcase wt (kg) × calving rate cow^{-1} × calf survival rate × stocking rate} — hand feeding costs for cows and calves — (20 × stocking rate).

Calving time	Early		Late	
Stocking rate	High	Low	High	Low
Years I & II	2.16	1.08	2.16	1.08
Years III & IV	1.85	1.24	1.85	1.24
I (1966)	31	42	8	53
II (1967)	21	43	—34	39
Mean of I & II	26	43	—13	46
III (1969)	99	89	73	72
IV (1970)	82	79	80	84
Mean of III & IV	91	84	77	78

The frequency with which interactions over-shadowed main effects, and consideration of likely interactions from varying suckling periods, indicate the requirement of impracticably large research resources to estimate accurately these management effects. It is suggested that simulation may yield reasonable answers at less cost.

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