Factors influencing recalving rate in lactating beef cows in the sweet dry bushveld of northern Transvaal

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Factors influencing the recalving rate of 2 165 lactating beef cows of four pure breeds (Afrikaner, Hereford, Bonsmara and Simmentaler) and three cross-bred types were investigated on the Mara Research Station between 1972 and 1982. Average recalving rate was 88.3%. The influence of year, breeding group, cow age, date of calving and body mass at four stages was investigated. Recalving rate differed significantly ($P \leq 0.05$) between years varying from 76.2 to 92.5%, but significant year × breeding group ($P \leq 0.01$) and breeding group × date of calving ($P \leq 0.05$) interactions were also indicated. Body mass was unimportant ($P > 0.05$) as a predictor of recalving rate. However, cows with average body mass were more inclined to recalve than those with extreme body masses.

Faktore wat die herkalwing van 2 165 lakterende vleisraskoeie van vier suiwer rasse (Afrikaner, Hereford, Bonsmara en Simmentaler) en drie kruisrastipes beïnvloed het, is tussen 1972 en 1982 op die Mara Navorsingstasie ondersoek. Die gemiddelde herkalwingspersentasie was 88.3%. Die invloed van jaar, teelgroep, koei-ouderdom, kalwingsdatum en liggaamsmassa op vier stadia geneem, is ondersoek. Herkalwingspersentasie het slegs betekenisvol ($P \leq 0.05$) tussen jare verskil en het tussen 76.2 en 92.5% gevarieer. Betekenisvolle interaksies vir jaar × teelgroep ($P \leq 0.01$) en teelgroep × datum van kalwing ($P \leq 0.05$) is ook aangetoon, terwyl liggaamsmassa 'n onbelangrike ($P > 0.05$) voorspeller van herkalwing was. Liggaamsmassas van koeie wat nie herbeset is nie, het egter meer gevarieer as dié wat wel beset geraak het. Koeie met gemiddelde massa was egter meer geneig om te herkalf as dié met uiterste massas.

Keywords: Beef cattle, body mass, calving age, recalving.

Reproductive rate is the most important factor influencing profitability of meat production. Early recalving of the lactating cow is influenced by several environmental factors and this should be taken into account in management of the beef herd. The relative importance of these factors varies from situation to situation and is related to climatic factors (Venter *et al.*, 1973), nutritional status of the veld (Lishman *et al.*, 1984b) and the production system (Steenkamp, 1977). Reproduction becomes even more important in the intensive compared to extensive systems (Steenkamp, 1977).

The influence of body mass on fertility of the beef cow has been a subject of several studies (Broster, 1974; Meaker, 1975; Steenkamp *et al.*, 1975; Bellows & Short, 1978; Levine *et al.*, 1980; Meaker *et al.*, 1980; Lishman *et al.*, 1984a; 1984b; MacGregor & Swanepoel, 1992). Although not consistently demonstrated, most of these investigations indicated a positive association between cow body mass and (re)conception.

The objective of this investigation was to evaluate factors influencing recalving in lactating beef cows of several breeds (or breeding groups) in the northern Transvaal sweet dry bushveld.

Data from 2 165 cow–year records (breeding opportunities) from 271 cows of four beef cattle breeds, i.e. Afrikaner (A), Hereford (H), Bonsmara (B), and Simmentaler (S) and three cross-bred types, viz. H × A (F_1), S × A (F_1), and S × (H × A), collected at the Mara Research Station between 1972 and 1982 (Table 1), were used in this investigation. Since only recalving rate was investigated, calving data of heifers and cows which failed to calve the previous year, were excluded.

Table 1 Number of females mated per breed (or cross-bred group) per year

	Breeding groups[1]						
Year	A	H	B	S	(H × A)	(S × A)	S × (H × A)
1972	88	54	51	48	28	32	34
1973	26	23	27	30	24	25	27
1974	24	30	27	19	29	26	28
1975	24	25	25	24	27	29	29
1976	28	26	25	24	25	26	28
1977	26	24	26	24	27	28	29
1978	25	27	24	25	27	27	25
1979	25	25	10	27	25	28	27
1980	21	26	20	27	25	27	30
1981	25	26	28	28	30	24	30
1982	32	28	25	24	29	27	27
Total	344	314	298	300	296	299	314

[1] A = Afrikaner; H = Hereford; B = Bonsmara; S = Simmentaler.

Multiple sire mating at 5% males was used. Sires were tested for fertility and libido prior to the mating season which lasted from the beginning of January through March. Approximately 25% of the cows were replaced annually. Replacement criteria were deaths, injuries, failure to calve two years in succession and weaning mass of their calves. Heifer replacements were based on high post-weaning mass.

Calving date and cow age were recorded. Cows were classified as those calving during the first half (early calvers = 1 October to 14 November) and those calving during the second half (late calvers = 15 November to 30 December) of the three-month calving season. Cow age varied from 3 to 12 years and was categorized into four classes (3 years, 4 years, 5–8 years, and 9 years and older). Cows were weighed after calving, at both the beginning and end of the mating season and at weaning of their calves.

The 2 165 calving records were analysed using the SAS procedure for categorical data modelling, PROC CATMOD. The PROC GLM was used for body mass (SAS, 1985).

With cows being the experimental units, repeated measures were involved. However, as a result of the general low repeatability (<0.10) of reconception rate (Meyer *et al.*, 1990), observations were treated as being independent. Body mass in the previous year was fitted as independent variable for realized calving data in the subsequent year.

The unbalanced nature of the data set and a large number of empty cells implied a very difficult data analysis. A simple strategy, intended to avoid such an analysis, was to select a number of models on the basis of their intuitive appeal, and to fit these models to the data. Fixed effects and interactions included in the models are listed in Table 2.

Levels of significance of those effects and their interactions influencing recalving rate are also presented in Table 2. Recalving rate was significantly affected by year ($P \leq 0.05$) and the year × breeding group ($P \leq 0.01$) and breeding group × date ($P \leq 0.05$) interactions only. Average recalving rates per breeding group per year are presented in Table 3.

Average recalving rate over the whole period was 88.3%. It varied from 76.2% to 92.5% over years, from 81.4% (Afrikaner) to 93.3% (Simmentaler) over breeding groups and from 51.1% to 100% per year over breeding groups.

Despite persistent precautionary measures against infections, it was established that in all herds, but especially in the

Table 2 Effects and first-order interactions into several (1 to 9) alternative models and level of significance (P)

Effects and interactions	Number of levels	Models 1	2	3	4	5	6	7	8	9	P^c
Year	11	x	x	x			x	x	x	x	*
Breed	7	x			x	x	x	x	x	x	NS
Age of cow	3		x		x						NS
Calving date	2			x		x					NS
Body mass at:											
Calving							x				NS
SMS[a]								x			NS
EMS[b]									x		NS
Weaning										x	NS
Interactions:											
Year × breed	77	x									**
Year × age	33		x								NS
Year × date	22			x							NS
Breed × age	21				x						NS
Breed × date	14					x					*

[a] Start of mating season.
[b] End of mating season.
[c] NS = Non-significant; * = $P \leq 0.05$; ** = $P \leq 0.01$.

Table 3 Mean recalving rates per breeding group per year

Years	Breeding groups[a] A	H	B	S	(H × A)	(S × A)	S × (H × A)	Mean
1972	79.7	89.4	91.8	98.7	97.8	90.5	89.0	89.2
1973	92.2	100.0	91.4	92.4	96.3	91.7	94.4	92.5
1974	64.9	88.5	93.2	100.0	95.2	100.0	100.0	89.0
1975	86.1	94.4	89.4	91.1	95.8	93.7	95.0	89.8
1976	70.3	97.9	88.2	100.0	95.8	92.7	88.2	89.3
1977	82.8	100.0	90.5	92.9	94.9	93.8	96.1	89.0
1978[b]	80.0	85.5	51.1	90.3	82.8	96.3	97.4	76.2
1979[b]	65.8	89.3	95.2	100.0	73.9	86.9	97.8	85.1
1980	81.4	94.1	81.9	100.0	96.7	91.1	97.9	86.5
1981	88.0	100.0	78.9	90.2	94.1	93.3	94.3	88.8
1982	85.7	100.0	96.8	85.6	93.8	78.9	91.9	91.7
Mean	81.4	93.0	86.7	93.3	91.6	91.6	93.0	88.3

[a] For abbreviations, see Table 1.
[b] Number of cows (especially in the Bonsmara) positive for *Brucella abortus*.

Bonsmara, a small number of cows were positive for contagious abortion (*Brucella abortus*). This unforeseen occurrence was possibly responsible for the drop in the reconception rate of the breeding groups during 1978 and 1979. The Bonsmara had a reconception rate of only 51.1% during 1978. This would have contributed to the significant ($P \leq 0.01$) year × breeding group interaction. It was not possible to include *Brucella abortus* in the model, since all cows were not tested every year.

Age of cow was also not significant, as was the case with calving date. A significant ($P \leq 0.05$) breeding group × calving date interaction was, however, apparent. These differences between breeding groups are presented in Table 4. Afrikaner cows tended to calve later than the other groups. Only 8.4% calved during the first half of the calving season (early calving), while 91.6% were late calvers. In the case of the Bonsmara, corresponding values were 29.2 and 70.8%. Only 79.2% of the late calving Afrikaner cows recalved, while 95.0% of the early calvers did. The Hereford tended to calve earlier (67.8% early calvers), while in the other breeding groups the majority was also late calving. Recalving rate was high in all other breeding groups and was not influenced by date of calving.

In general, *Bos taurus* type cows calve significantly earlier in the calving season than *Bos indicus* types (Bonsma & Skinner, 1969; Holroyd *et al.*, 1979; Gotti *et al.*, 1985). This is to some degree supported in this study. This is partly so because of a longer gestation period (approx. 6 days) (Joubert & Bonsma, 1959; Van Graan & Joubert, 1961; Skinner & Ziervogel, 1962) as well as a prolonged lactation-anoestrus period of 116 to 467 days (Joubert, 1954; Wiltbank *et al.*, 1961; Baker, 1969) in the Afrikaner.

The inability of the Afrikaner to reconceive within a relatively short period after calving is attributed to an irregular ovarian function, that might be symptomatic of a basic disfunction of the neuro-endocrine or somatic components of the reproductive system (Wells *et al.*, 1981). Mackinnon *et al.* (1989) indicated that Afrikaner types were more limited by body mass differences than other breed types.

Body mass of cows at calving, at the start (SMS) and at the end (EMS) of the mating season and at weaning had no significant ($P > 0.05$) effect on recalving (Table 3). Least-squares means, range and per cent difference between the lightest and heaviest cows are presented in Table 5.

At all stages the cows which recalved were on average only 2% ($P > 0.05$) lighter than those which did not. There was, however, less variation between those which recalved compared to those which did not, probably indicating that cows at the extremes were more inclined not to recalve. Although the influence of body mass at any stage was not a significant source of variation, a possible optimum body mass for maximum recalving was apparent, rather than the minimum target mass concept proposed in most other studies. This is illustrated in Figure 1 for four body mass categories where the body masses varied from 337 to 553 kg.

In most other investigations, where lower recalving rates were reported, several other factors were also important (e.g.

Table 4 Distribution (%) of cows calved and recalved within two calving date categories per breeding group

Breeding group[1]	Percentage calved		Percentage recalved	
	Early calving	Late calving	Early calving	Late calving
A	8.4	91.6	95.0[a]	79.2[b]
H	67.8	32.2	95.0	92.4
B	29.2	70.8	87.6	82.7
S	41.3	58.7	94.9	92.5
(H × A)	33.1	66.9	91.7	91.4
(S × A)	22.7	77.3	90.7	92.9
S × (H × A)	42.4	57.6	93.9	93.0

[a,b] $P \leq 0.05$.

[1] For abbreviations, see Table 1.

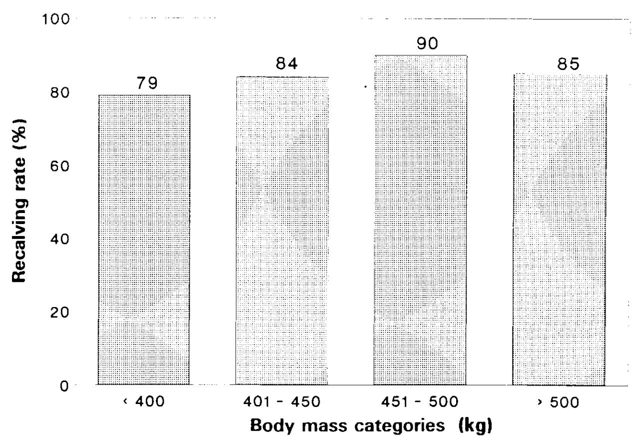

Figure 1 The influence of body mass at the start of the mating season on recalving rate (%) for four body mass categories.

Table 5 Least-squares means, range and percentage difference between lightest and heaviest cows of those calved and those not

		Body mass at			
		Birth	SMS[a]	EMS[b]	Weaning
Not calved	LSM ± *SE*	459.2 ± 6.93	462.3 ± 6.66	492.2 ± 7.90	507.8 ± 7.89
	Range	410.7 – 517.5	398.3 – 511.1	458.3 – 534.2	455.2 – 552.6
	Difference (%)	26.0	28.3	16.6	21.4
Calved	LSM ± *SE*	450.2 ± 2.78	455.8 ± 3.06	488.6 ± 3.18	507.4 ± 3.48
	Range	413.7 – 478.4	409.6 – 496.1	471.5 – 510.9	470.4 – 533.5
	Difference (%)	15.6	21.1	8.4	13.4

[a] Start of mating season.

[b] End of mating season.

age of cow, date of calving, and body mass). The high management level and low stocking rate, resulting in a high recalving rate in the present study, may be the reason for this contradictory result. In light of this high recalving rate, it could be argued that the situation at the Mara Research Station is not comparable to the whole region, where lower recalving rates are normally obtained. This probably indicates that under favourable conditions, recalving is not restricted by breeds, body mass or age of cow.

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Synchronization of oestrus in sheep: Use of different doses of progestagen outside the normal breeding season

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One hundred and thirty Merino ewes were used to test the efficiency of different doses of medroxyprogesterone acetate (MAP) progestagen to synchronize oestrus outside the breeding season. Three treatments, consisting of intravaginal progestagen doses (60 mg, 40 mg and halved 60 mg MAP sponges) were applied for 14 days. Each ewe (35 per treatment) received an intramuscular injection of 300 IU PMSG at sponge withdrawal. The fourth group ($n = 25$) served as a control. No significant difference was found in the oestrous response and the duration of the induced oestrous period between the different treatments following sponge withdrawal. The mean length of the induced oestrous period for all treatments did not differ significantly from the natural oestrous period (29.4 ± 7.6 vs. 25.9 ± 6.8 h, respectively). The mean serum LH and progesterone concentrations for the observation period did not differ significantly between the 60 mg, 40 mg and halved-sponge treatments (6.95 ± 8.74 and 0.28 ± 0.33; 9.17 ± 13.38 and 0.33 ± 0.47; 6.83 ± 6.09 and 0.20 ± 0.16 ng/ml, respectively). For the respective treatments, the mean position of the LH peak was 45.6, 46.8 and 42.0 h following sponge withdrawal, and 4.8, 3.6 and 0 h (oestrus) following the onset of oestrus, compared to 6.0 h for the control. MAP absorption over the 14-day period was 20.4% for the 60 mg treatment, 41.5% for the 40 mg treatment and 41.2%