Reconception and body-mass changes of energy supplemented first-calver beef cows and growth of their creepfed calves

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The effect of dietary supplementation using 2,3 kg maize meal per day on change in body mass during early lactation and on the calving rate of first-calf Afrikander, Sussex and Hereford type cows which grazed the Tall Grassveld of Northern Natal was studied. Half of the suckling calves were also allowed access to a creepfed.

Provision of a dietary energy supplement reduced the body mass loss by an average of only 0,02 kg per day and no consistent effect on the reconception rate was observed. In general, those cows which produced a calf after being exposed to breeding bulls for 65 days showed a higher body mass at first calving and at both the onset and the conclusion of the subsequent breeding period than cows which would not calve the following year. Amongst the Afrikander cows the interval from calving to the onset of the next breeding period accounted for 38,2 % of the variation in calving rate. For all breeds, the calving rate increased by 4,7 % for every ten days earlier calving.

The average growth of the calves between the ages of two months and weaning (seven months) was significantly improved by 120 g per day where 0,9 kg creepfeed was supplied daily. During this period the daily gain was influenced by, in order of importance, the body mass at two months, the provision of creepfeed, and the breed-type of the dam. Over the entire suckling period (birth to weaning) the growth rate was affected by the body mass of the dam at parturition, the provision of creepfeed, the breed-type of the dam and the sex of the calf.
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Die invloed van byvoeding met 2,3 kg mieliemeel per dag op die verandering in liggaamsmassa gedurende vroeë laktasie en op die herbesetting van eerste-kalf Afrikaner, Sussex en Hereford-tipe koeie wat in die Langgrasveld van Noord-Natal gewei het, is bestudeer. Die helfte van die kalwers het toegang tot kruipvoer gehad. Die gewigsverlies van die koeie is gemiddeld met slegs 0,02 kg per dag deur byvoeding verminder en geen duidelike herbesettingsvoordeel is waargeneem nie.

Oor die algemeen het koeie wat herbeset is na 65 dae van paring, 'n hoër massa by eerste kalwing gehad en by beide die begin en einde van die daaropvolgende paarperiode as koeie wat nie die daaropvolgende jaar sou kalf nie. By die Afrikanertipes was die periode vanaf kalwing tot aanvang van die volgende paringsperiode verantwoordelik vir 38,2 % van die variasie in herbesetting. Waar rasverskille geïgnoreer is, was die herbesetting 4,7 % hoër vir elke tien dae wat die koeie vroeër gekalf het. Die gemiddelde groeitempo van die kalwers tussen twee en sewe maande is betekenisvol verhoog met 120 g per dag deur 'n daaglikse inname van 0,9 kg kruipvoer. Gedurende hierdie periode is die daaglikse massatoename beinvloed deur, in volgorde van belangrikheid, die liggaamsmassa by twee maande, kruipvoeding en rastipe van die moer. Die groeitempo vanaf geboorte tot speen is beinvloed deur die liggaamsmassa van die moer by kalwing, kruipvoeding, rastipe van die koei en die geslag van die kalf.
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Introduction

It is generally accepted that beef heifers conceive at a high rate during their first breeding season provided they have grown sufficiently (Bellows, 1968; Arije & Wiltbank, 1974). However, when breeding takes place while they are suckling their first calf the pregnancy rate is low (Bauer, 1965; Harwin, 1967). The nutritional requirements for growth of the young cow in addition to those for lactation are not usually met by the natural grazing available. The resumption of reproductive cycles is therefore considerably delayed, so that many first-calvers show heat only after the mating period has ceased. Harwin (1967) suggested that the calving rate of the herd as a whole could be increased by 10 to 15 % simply by additional feeding after the cow has calved for the first time. The problem can also be overcome by mating heifers so that they calve some four to six weeks before the cow herd. Although this allows a longer recovery period after parturition, this practice does extend the calving period of the herd as a whole. Furthermore, the heifers then calve at a time which is more beneficial to the growth of the suckling calf than to the reconception of the lactating dam.

The purpose of this experiment was to determine whether increasing the dietary energy intake would reduce the loss in body mass during lacation and thereby increase the reconception of first-calvers and to determine whether creepfeeding of the calves would compensate for the low milk production of such cows.

Procedure

In the Tall Grassveld of Northern Natal (Dundee Research Station), Afrikander and Sussex-Afrikander type heifers were mated to Sussex bulls, and Hereford type heifers to a Hereford bull so that calving would commence in August.

At parturition, the cows were allocated randomly (within breed type) to two groups. One group of cows was fed 2,3 kg maize meal per day. This was supplied from calving until the end of the subsequent breeding period. The other group received no dietary energy supplement. From the age of two months until weaning at 205 days, half the calves in each group had access to creepfeed (80 parts maize meal: 10 parts fishmeal: 10 parts sunflower oilcake meal), fed at the rate of 0,9 kg per day. The remaining calves were suckled without creepfeed.

During the winter, prior to calving, the pregnant heifers received maize silage (13,5 kg/day), *Eragrostis curvula* hay (4,5 kg/day) and 0,7 kg urea block per day. The veld grazing utilized during summer was divided into four camps which were grazed in rotation for seven day periods. Each treatment group

grazed in every camp. Breeding bulls (Sussex) were joined with the cows for 65 days starting on 17 October. The bulls were interchanged between the various groups each week. Reconception was based on cows calving and the date of service was derived from the calving date. All animals were weighed at four week intervals. The body mass of each cow and that of her calf were also recorded on the day of parturition.

Treatment effects on changes in body mass of the cows and on growth of the calves were tested by least squares analysis. The effect of cow mass at calving on cow gains during the post-partum period was corrected for by covariance. Differences in characteristics of cows which reconceived were compared to those of cows not recalving using Student's *t*-test. Association between selected variates was measured by regression analysis and a stepdown regression procedure was employed to examine the factors suspected of influencing post-partum body-mass change of cows, reconception and also growth of calves. Chi-square analysis was used to test treatment differences in conception rate.

Results

The average daily gain in body mass (ADG) of the cows from calving until the end of the subsequent mating period (Table 1) depended on cow mass at calving (Table 2). The adjusted gain in mass during this period (*i.e.* the period of supplementary energy feeding) indicated a significantly ($P \leqslant 0,05$) greater loss amongst the Hereford type cows (Table 2). However, body mass at parturition differed between breed types (Table 2), and because of limited animal numbers the covariance analysis was based on all three breeds. Consequently, the correction of the ADG is not entirely satisfactory. By limiting the regression analysis to the Afrikander type females only, a significant correlation between body mass at calving (X) and ADG (Y) was obtained. However, only 6,0 % of the variation in Y could be accounted for, and not much can be gained by correcting Y. The mean daily loss in mass for all supplemented cows was 0,10 kg while the non-supplemented females experienced a decrease of 0,12 kg per day. Clearly supplementation was of no value in terms of ADG (Table 2).

Reconception

Supplementary feeding appeared to benefit (non-significantly) the reconception of only the Afrikander type cows where the calves also had access to a creep ration (Table 3). Amongst the other two breed types the results were highly variable. The Sussex type cows were notably superior to the other two breed types.

Table 2 Gain in body mass of lactating first-calvers adjusted for body mass at calving

Breed	Mass at parturition (kg)	Average daily gain, parturition to end of mating period (kg)
Afrikander	418,0[a]	−0,10[a]
Sussex-Afr.	440,2[b]	−0,01[a]
Hereford	370,0[c]	−0,20[b]
SE	±4,9	±0,03

[a,b,c] Means in columns with different superscripts differ significantly ($P \leqslant 0,05$).

The Afrikander cows that re-calved, consistently showed a greater body mass than those which did not calve again (Table 4), although the change in body mass was contrary to expectation. Classification of the cows (all breed types combined) according to the body mass at parturition, indicated that the calving rate was significantly dependent on the body mass (Figure 1) with 96,5 % of the variation being accounted for. This finding is biased since the Hereford type cows, which showed low calving rates, tended to have relatively low body masses, while the Sussex types, with relatively high body masses, also exhibited good reconception. Restricting the analysis to the 68 Afrikander type cows, revealed that 87,9 % of the variability in calving rate was due to variation in body mass at parturition.

There was no significant association between the body mass at calving ($\bar{x}$ = 430,3 kg) and the interval from parturition to conception ($\bar{x}$ = 79,3 days). Amongst the Afrikander type cows the relationship was significant ($P \leqslant 0,01$) although only 12,5 % of the variation in the interval to conception could be accounted for in terms of variation in body mass at calving. In addition to being of lower body mass at calving, those Afrikander and Hereford type cows which did not re-calve were joined with bulls at a shorter interval (Herefords: $P \leqslant 0,001$) after calving than the cows which re-calved (Table 5). Since the bulls remained with the cows for 65 days and those cows

Table 1 Changes in body mass of lactating cows as influenced by provision of an energy supplement

Feeding treatment				Average body mass (kg) at:		Average daily gain (kg)	Average body mass (kg) conclusion of lactation
Cow	Calf	Breed	*n*	Parturition	End mating period		
Supplemented	Supplemented	Afrikander	17	427,3	414,6	−0,14	408,0
		Sussex-Afr.	6	440,2	437,5	−0,03	425,4
		Hereford	6	368,7	360,8	−0,15	374,2
		SE		± 16,7	± 7,1	±0,17	± 6,8
Supplemented	Control	Afrikander	16	400,8	396,2	−0,07	388,7
		Sussex-Afr.	4	423,2	439,7	±0,11	422,1
		Hereford	5	375,2	355,3	−0,11	364,3
		SE		± 12,6	± 7,6	±0,30	± 7,3
Control	Supplemented	Afrikander	16	421,7	411,6	−0,09	399,4
		Sussex-Afr.	4	420,3	418,4	−0,02	409,2
		Hereford	5	301,0	374,1	−0,12	369,8
		SE		± 18,8	± 7,6	±0,24	± 7,25
Control	Control	Afrikander	19	420,6	407,9	−0,15	394,3
		Sussex-Afr.	5	470,4	448,9	−0,20	432,4
		Hereford	6	361,7	349,1	−0,15	346,9
		SE		± 20,0	± 6,9	±0,20	± 6,7

Table 3 Reconception of first-calvers when fed a maize supplement during early lactation

Feeding treatment			Cows:			Intercalving
Cow	Calf	Breed	Joined	Calved	%	interval (days)
Supplemented	Supplemented	Afrikander	17	11	64,7	376,0
		Sussex-Afr.	6	5	83,3	362,0
		Hereford	6	3	50,0	365,0
Supplemented	Control	Afrikander	16	2	12,5	365,0
		Sussex-Afr.	4	3	75,0	361,7
		Hereford	5	1	20,0	382,0
Control	Supplemented	Afrikander	16	4	25,0	352,5
		Sussex-Afr.	4	3	75,0	348,7
		Hereford	5	3	60,0	364,7
Control	Control	Afrikander	19	5	26,3	371,4
		Sussex-Afr.	5	3	60,0	351,0
		Hereford	6	0	0,0	–
						SE + 12,6

Table 4 Body-mass characteristics of cows which may be related to reconception

		Body mass (kg) at:			Average change in body mass (kg) during breeding period	Average maximum loss in body mass (kg) from calving to joining with bulls	Average daily gain in body mass (kg), calving to end breeding period
Breed type	Reproductive status	Parturition	Onset of breeding period	Conclusion of breeding period			
Afrikander	Calf	^{a}442,0 ± 9,1	^{c}440,4 ± 11,1	^{e}432,7 ± 10,3	^{g} – 5,6 ± 2,1	^{i} – 25,6 ± 2,6	^{j} – 0,12 ± 0,04
	No calf	^{b}404,4 ± 5,2	^{d}394,3 ± 5,5	^{f}395,7 ± 4,6	^{h} + 1,1 ± 2,1	^{i} – 31,8 ± 3,1	^{j} – 0,11 ± 0,04
Sussex-Afr.	Calf	^{a}439,7 ± 9,3	^{b}443,4 ± 9,5	^{e}438,7 ± 8,0	^{d} + 0,6 ± 5,6	^{e} – 22,1 ± 5,7	^{f} – 0,02 ± 0,04
	No calf	^{a}442,3 ± 23,9	^{b}441,0 ± 23,1	^{e}431,7 ± 21,2	^{d} – 5,2 ± 2,6	^{e} – 28,1 ± 10,3	^{f} – 0,10 ± 0,09
Hereford	Calf	^{a}382,0 ± 11,9	^{b}383,1 ± 12,1	^{e}376,9 ± 12,2	^{d} – 6,9 ± 1,8	^{e} – 22,0 ± 5,9	^{f} – 0,06 ± 0,06
	No calf	^{a}363,4 ± 8,0	^{b}360,0 ± 7,6	^{e}354,1 ± 8,4	^{d} – 6,1 ± 3,6	^{e} – 29,3 ± 5,2	^{f} – 0,18 ± 0,08

$^{a-j}$ Means in columns with a breed type having the same superscript do not differ ($P \geqslant 0,05$)

which re-calved did so on average 75,5 days after calving (range 28 to 126 days), it is possible that a delayed onset of oestrus after parturition might have contributed to the low reconception rates. Classification of all the cows according to the interval from calving to commencement of the next breeding period (X) suggested a trend towards increasing conception rates (Y) as the cows calved earlier (Figure 2). Although 30,5 % of the variability in Y could be accounted for the correlation coefficient of 0,55 was non-significant (r = 0,58 required for $P \leqslant 0,05$).

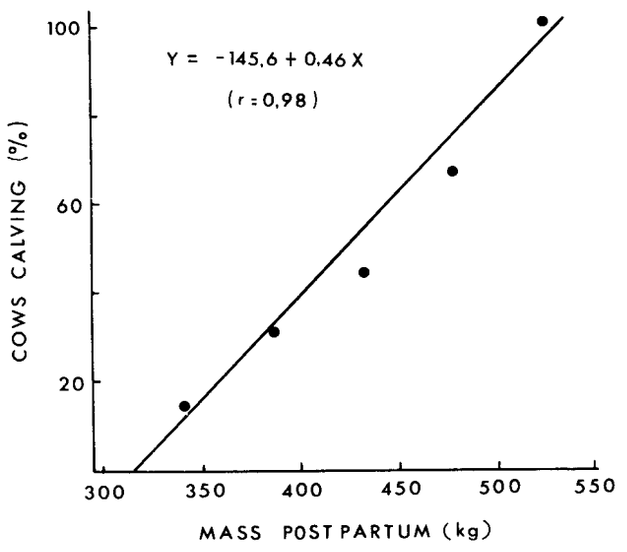

Figure 1 Changes in calving % of first calvers as influenced by body mass at parturition

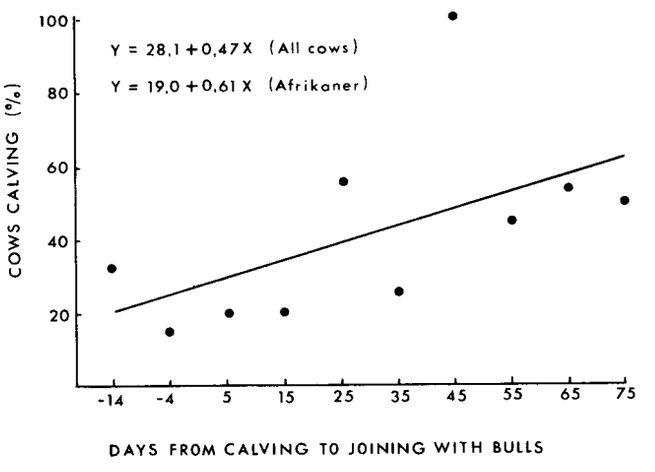

Figure 2 Calving rate as influenced by time of calving in relation to onset of subsequent mating period

Table 5 Reconception of different breed types and relationship of time of calving to onset of subsequent breeding period

Breed	Cows: Joined with bulls	Calved No.	Calved %	Interval (days) parturition to joining with bulls: For cows calving	For cows not calving	Interval (days) introduction of bulls to conception	Interval (days) parturition to conception	Intercalving interval (days)
Afrikander	68	22	32,3	[a]39,3 ± 4,4	[a]30,8 ± 4,0	44,3 ± 3,3	83,9 ± 4,5	369,7 ± 4,9
Sussex-Afr.	19	14	73,4	[b]39,5 ± 5,0	[b]51,0 ± 1,7	30,0 ± 4,1	70,6 ± 6,4	356,3 ± 5,9
Hereford	22	7	31,8	[c]36,2 ± 7,3	[d] 7,8 ± 2,7	46,6 ± 6,0	83,0 ± 10,0	367,3 ± 10,1

[a,b,c,d] Means in the same row within a breed with different superscripts differ significantly ($P \leqslant 0,01$)

Limiting the analysis to the Afrikander cows resulted in the regression:

$$Y = 19,02 + 0,61\ X$$

The regression was significant ($P \leqslant 0,05$) and 38,2 % of the variation in Y was explained in terms of X.

The use of conception rate as the dependent variable necessitates the grouping of animals into selected classes. To avoid this procedure the interval between the onset of the breeding period and the date of conception (calculated form the calving date) was used as the dependent variable (Y) and the interval from calving to the onset of the breeding period as the independent variable (X). Only by eliminating cows which had a body mass of less than 410 kg at parturition could a significant regression be established.

When the interval between calving and the introduction of bulls was considered in conjunction with the body mass of the Afrikander type cows at the onset of breeding (Table 6), it appeared that:

(a) For those cows which re-calved, if breeding commenced:
  (i) less than 45 days post-partum then 75 % of the cows had a body mass greater than 410 kg.
  (ii) more than 45 days post-partum then 60 % calved even though they had a mass of less than 410 kg.

(b) For cows which did not reconceive if breeding commenced:
  (i) more than 45 days post-partum, 80 % of the 15 animals had a mass of less than 410 kg.
  (ii) less than 45 days post-partum only 35,5 % of the 31 cows had a body mass of more than 410 kg. The difference was significant ($P \leqslant 0,05$).

Categorization of the cows on the basis of the interval from calving to the onset of breeding showed that:

(a) For the cows less than 45 days post-partum:
Only 13 % having a body mass less than 410 kg conceived, but significantly more cows (45 %) conceived at a body mass exceeding 410 kg. This represents a factor of 3,5 times in favour of the cows with the greater body mass.

(b) For the cows more than 45 days post-partum:
Of the cows only six (33,3 %) having a body mass below 410 kg conceived and the conception rate was 57,1 % when the body mass exceeded 410 kg. This difference was non-significant.

No reason could be found for the five Sussex type cows which did not re-calve, but the Hereford type cows were clearly at a disadvantage in view of the short period between calving and onset of the next breeding period (Table 5).

Suckling calves

During the creepfeeding phase (two to seven months) the average daily gain (ADG) of the calves (Y_1) was mainly dependant on the mass of the calves at the onset of this phase (Table 7). This variate was in turn correlated ($r = 0,41$) with the body mass of the dam at calving (Y_6) and the latter variate was

Table 6 Influence of body mass at the onset of the breeding period and post-partum interval to annual mating season on reconception of first-calf Afrikander cows

Average body mass of cows	Days from calving to onset of breeding period: < 45 days: Reconceiving No. of cows	%	Not reconceiving No. of cows	%	> 45 days: Reconceiving No. of cows	%	Not reconceiving No. of cows	%
< 410 kg	3	25,0	20	64,5	6	60,0	12	80,0
> 410 kg	9	75,0	11	35,5	4	40,0	3	20,0

Table 7 Factors influencing the preweaning average daily gain (ADG) of calves

Variates included in regression analysis	Variates significantly influencing: ADG during creepfeeding phase Y_1	Order of importance	ADG birth to weaning Y_2	Order of importance
Creepfeeding of calf — X_1	X_1	2	X_1	2
Mass of calf at birth — X_2	–		–	
Mass of calf at onset of creep-feeding — X_3	X_3	1	excluded	
Sex of calf — X_4	–		X_4	4
Suppl. of dam — X_5	–		–	
Mass of dam at parturition — X_6	–		X_6	1
Av. daily mass change of dam during creep-feeding phase OR during pre-weaning phase — X_7	–		–	
Breed of dam — X_8; X_9	X_8; X_9	3	X_8; X_9	3

Regression equations: $Y_1 = 0,49 + 0,23\ X_1 + 0,001\ X_3 + 0,09\ X_4 + 0,04\ X_8 + 0,13\ X_9$.

$Y_2 = 0,44 + 0,18\ X_1 + 0,12\ X_4 + 0,0003\ X_6 + 0,06\ X_8 + 0,10\ X_9$.

therefore not shown to contribute significantly to the variation in Y_1. The factors shown to be significant, *i.e.* X_3, X_1, X_8, X_9 contributed 21,1, 15,1 and 8,3 % respectively to the 44,5 % variation in Y_1.

The ADG over the entire suckling period of seven months was markedly influenced by the 'body mass of the cow at calving' and variation in this factor explained 20,7 % of the accountable 46,3 % variation in Y_2. The remaining variables of significance *viz.* 'creepfeeding of the calf', 'breed type of the dam' and 'sex of the calf' contributed 13,5, 8, and 3,3 respectively to the variation in Y_2.

The influence of the breed type of the dam on the growth of the calf is reflected in the adjusted gains (Table 8). Over all breeds the 0,10 greater daily gain of the creepfed calves yielded an average 18,0 kg advantage in body mass at weaning over the unsupplemented animals. Although the steers gained only 0,005 kg per day more than the heifers during the creepfeeding period, the results have been presented for each sex (Table 8) in order to simplify comparisons. The adjusted daily gain in body mass of the calves from Hereford type dams (average = 0,69 kg) was 0,15 kg lower than that of calves from Sussex type dams (average = 0,84 kg) and 0,12 kg greater than that of calves suckled by Afrikander type cows (average 0,81 kg). Although the breed type effects were still evident amongst the creepfed calves, creepfeeding of the poorest calves enabled them to grow almost as quickly as the best calves that were not creepfed.

Table 8 Least squares means for adjusted preweaning growth of calves creepfed from two months until weaning five months later and 205-day weaning mass

		Average daily gain (kg) during:				
		Creepfeeding period		Period birth to weaning		205-day corrected weaning mass kg
Treatment	Breed of dam	Steers	Heifers	Steers	Heifers	
Creepfed	Afrikander	0,88	0,83	0,88	0,84	214,2
	Sussex-Afr.	0,93	0,87	0,92	0,85	215,9
	Hereford	0,75	0,79	0,75	0,71	189,6
Control	Afrikander	0,78	0,72	0,79	0,74	194,5
	Sussex-Afr.	0,81	0,76	0,85	0,77	201,7
	Hereford	0,63	0,58	0,68	0,61	164,4

Discussion

In view of the small number of animals representing the Sussex and Hereford types it would appear reasonable to focus attention on the trends observed amongst only the Afrikander type females. Here, the strikingly higher calving rate of the cows that were supplemented while their calves received creepfeed compared to the other treatment groups is of interest. It is difficult to find an explanation for the result obtained. Neither the date of calving, the body mass of the cows nor the preweaning growth of the calves were individually more to the advantage of cows in this treatment group than in any of the others.

The Afrikander cows which did not reconceive joined the bulls on average 30,8 days after calving (Table 5). With a mating season of 65 days this means that the cows would have had to conceive not later than 96 days after calving. There was a relatively even distribution of cows over the period −4 to 65 days between calving and joining with bulls. Furthermore, on the basis of the fitted line (Y = 19,0 + 0,61X) the conception rate improved by 6,1 % for every ten-day increase in the interval to joining. Assuming that the response remained linear, a calving rate of 100 % would have been achieved if the period from parturition to introduction of the bulls was extended to 133 days. The common conclusion that a short interval between calving and initiation of the next breeding season is an important factor contributing to low conception rates, requires more criticial evaluation.

From the data relating reconception rates to the body mass of the cows or the date of calving (Tables 5 and 6, Figures 1 and 2) it would appear justified to conclude that where cows calved more than 45 days prior to the onset of the next breeding period, body mass was of prime importance as regards recalving. Amongst cows which calved later, factors other than body mass may have exerted an influence. This conclusion is partially supported by Grosskopf (1976) who noted that many variables were associated with the likelihood of reconception. He drew particular attention to the body mass of the cow and the time of calving. The results in Table 4 confirm the finding that change in body mass during the breeding period is of relatively minor importance as regards reconception (Richardson, Oliver & Clarke, 1975; Carstairs, Morrow & Emery, 1980, Lishman, Lyle, Smith & Botha, 1983).

For each breed type of dam the benefit of creepfeeding (as reflected in 205-day mass) was proportional to the reputed milk production abilities of these types. Thus calves from Sussex-type dams showed the smallest benefit (14,2 kg) while calves suckled by Hereford-type females gained considerably (25,2 kg). This is in agreement with Hixon, Fahey, Kesler & Neumann (1982) who maintained that creepfeeding masked the milk production deficiency of Hereford cows. The present findings also support the contention (Harwin, 1963; Cooper, 1965; Ochoa, Mangus, Brinks & Denham, 1981) that creepfeed is best utilized by calves suckling cows with limited milk, due either to age or genetic make-up.

The magnitude of the benefit due to creepfeeding was similar to that recorded on the same veld type by Meaker (1978) and on other veld types by Lishman *et al.* (1982).

Conclusion

Supplementation of first-calf cows with a dietary energy concentrate from the time of parturition until the end of the breeding period did not consistently improve either maintenance of body mass or reconception. The preweaning gain of the suckling calves was influenced by creepfeeding and the body mass of the dam at parturition.

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