S. Afr. J. Anim. Sci. 9, 231–236 (1979)

PROTEIN AND/OR ENERGY SUPPLEMENTATION OF LACTATING BEEF COWS DURING THE EARLY SUMMER PERIOD IN NORTHERN NATAL

Receipt of MS 07-05-1979

H.J. Meaker, T.P.N. Coetsee[1] and A.W. Lishman[2]
Agricultural Research Station, P.O. Box 626, Dundee, 3000

(Key words: *Protein, energy, reproduction)*
(Sleutelwoorde: *Proteïen, energie, reproduksie)*

OPSOMMING: PROTEÏEN- EN/OF ENERGIEBYVOEGING AAN LAKTERENDE VLEISBEESKOEIE GEDURENDE DIE VROEË SOMERPERIODE IN NOORD NATAL

'n Studie is oor drie jaar uitgevoer om die invloed van proteïen- en/of energiebyvoeging aan lakterende vleisbeeskoeie oor 'n 100 dae periode, op die reproduksievermoë van hierdie koeie te bestudeer. Die gemiddelde herkalfpersentasie vir die koeie wat onderskeidelik energie-, natuurlike proteïen- en nie proteïen stikstofaanvullings ontvang het en vir die koeie in die Kontrole groep, was 96,0 persent, 85,8 persent, 85,8 persent en 73,1 persent. Die gemiddelde ru-proteïen (RP) inhoud van gesnyde grasmonsters vir die somer-, herfs-, winter- en lenteperiodes was onderskeidelik 5,88 persent, 4,20 persent, 3,80 persent en 5,67 persent. Die Ca en P inhoud van dieselfde monsters het geringe variasie getoon oor die vier seisoene en was gemiddeld 0,17 persent en 0,11 persent. Gebaseer op 'n aanname rakende die gemiddelde inname van 'n lakterende vleisbeeskoei en die chemiese samestelling van die grasbedekking, is dit bereken dat die weiding voorsien in 90 persent, 65 persent, 65 persent en 42 persent van die TVV, RP, Ca en P benodigdhede van die vleisbeeskoei (NRC, 1976).

SUMMARY:

An experiment was conducted to investigate the effects on the reproductive performance of lactating beef cows of supplementation with protein and/or energy during a 100 day period. Over three years the average recalving percentage for the cows receiving energy-rich-, natural protein-, and non protein nitrogen supplements and for the Control cows was 96,0 per cent, 85,8 per cent 85,8 per cent and 73,1 per cent respectively. The average crude protein (CP) content of clipped grass samples for the summer, autumn, winter and spring periods was 5,88 per cent, 4,20 per cent, 3,80 per cent and 5,67 per cent respectively. The Ca and P content showed no great variation over the four seasons and averaged 0,17 per cent and 0,11 per cent respectively. Based on an assumption concerning the average intake of a lactating beef cow and the chemical composition of the grass sward, it was estimated that the veld supplied 90 per cent, 65 per cent, 65 per cent and 42 per cent of the TDN, CP, Ca and P requirements (NRC, 1976) of the lactating beef cow.

The beef industry of Northern Natal is heavily dependent on the natural veld. Acocks (1953) refers to the veld in Northern Natal as Sour Grassveld and Mixed Grassveld and the natural vegetation consists mainly of *Hyparrhenia-Tristachya-Digitaria* spp., while large areas are devoid of trees. The quantity and quality of the vegetation varies mainly due to climatic and soil fertility conditions and is generally poor in both productivity and feed value. The summer veld in Northern Natal is characterized by the following:

(i) an imbalance between crude protein and energy content at the onset of the spring grazing season;

(ii) a drastic decrease in the total protein content of the veld as the grasses reach reproductive maturity;

(iii) a variable availability of plant material due to periodic droughts which in turn makes veld management difficult. The decrease in dry matter intake by the animal during droughts results in lowered animal production, and

(iv) a low calcium and phosphate content of the veld throughout the year.

These fluctuations in the natural vegetation impose limitations on the reproductive performance of the breeding cow and the live mass gain of the growing animal.

Conflicting results have been recorded when lactating beef cows were supplied with supplementary energy. Many studies have shown that when lactating cows are maintained on low levels of energy, irrespective of level of protein, ovarian inactivity results and consequently the interval to the first post partum oestrus is prolonged. (Bond, Wiltbank & Cook, 1958; Wiltbank,

Present address:
[1] : Private Bag X804, Potchefstroom, 2520
[2] : Department of Animal Science, University of Natal, Pietermaritzburg, 3200

Rowden, Ingalls, Gregory & Koch, 1962; Wiltbank, Bond & Warwick, 1965; Dunn, Ingalls, Zimmerman & Wiltbank, 1969; Lamond, 1970). However, when Bellows, Gibson, Thomas & Pahnish (1968) fed a grain supplement to breeding cows during the annual breeding period, they obtained no improvement in the reproductive performance. The explanation offered was that adequate grass was available in that particular year. This was confirmed by the mass changes observed amongst the cows and calves. Similarly, Zimmerman, Clanton & Matsushima (1961) fed Hereford cows different levels of protein and energy and found that 83 per cent of the cows on a high energy-high protein diet conceived to first service compared to only 38 per cent for those on a high energy-low protein diet. This effect of protein on conception rate was confirmed by Wallace & Raleigh (1967).

In view of the lack of information on the early summer supplementation of lactating beef cows in the Northern Natal area, the reproductive performance of such cows supplemented with protein and/or energy during the early summer period was studied.

Procedure

This experiment was replicated during 1974, 1975 and 1976 and the number of lactating Africander cross Sussex cows (aged between four and six years) randomly allocated to the four treatments was 58 (1974), 63 (1975) and 68 (1976), respectively. The following treatments were applied:

Group 1 : Control – minerals only.
Group 2 : Minerals plus non protein nitrogen (NPN)
Group 3 : Minerals plus protein.
Group 4 : Minerals plus energy.

The different treatments commenced towards the end of October of each year and terminated approximately 100 days later when the mating season ended. The composition of the four supplements is shown in Table 1.

Table 1

Composition of supplements fed to lactating cows grazing summer veld

		Supplements fed:			
		Minerals only	Minerals + NPN	Minerals + protein	Minerals + energy
Salt	%	33,3	31	25	25
Maize meal	%	-	34	–	60
Bone meal	%	66,7	20	15	15
Urea	%	-	15	10	
High protein concentrate	%		–	50	–
CP	%	2,0	47,1	49,2	6,4
TDN	%		27,2	38,0	48,0
Ca	%	19,9	6,0	7,2	4,5
P	%	9,2	2,8	3,0	2,2

The cows in the four treatment groups had access to approximately 180 ha of veld which was divided into 16 camps of equal size. The different groups were rotated once weekly thereby ensuring that each treatment grazed each camp. This procedure was followed to limit possible camp effects.

All the cows were bred annually for 65 days, from approximately December 1 to February 4. The supplements were replenished weekly so as to ensure that the cows had access to adequate supplies. The body mass of the cows was recorded at 14 day intervals.

Only one camp, situated in the centre of the 16 camps used for this experiment, was used for the collection of grass samples. At 14 day intervals and over a 12 month period, 20 grab samples were collected at random by clipping. The samples were then mixed together and subsampled for chemical analysis. Using standard procedures, the grass samples were analysed for CP, Ca and P.

Analysis of variance and least-squares analysis of variance were used to compare treatment means (Snedecor & Cochran, 1967).

Table 3

Average mass of cows, percentage recalving, weaning mass of calves and intercalving period of cows allowed access to four supplements

		Control	Supplement: plus NPN	plus protein	plus energy	Sign
1973/74:						
Start	kg	438,7	462,0	464,8	462,7	NS
End	kg	466,8	497,1	505,9	508,3	2,3,4, > 1
Difference	kg	28,1	35,1	41,1	45,6	
Significance		NS	< 0,05	< 0,05	< 0,05	
Recalving	%	81,3	92,9	92,9	100,0	
Weaning mass calves	kg	188	191	197	198	
Intercalving period	days	381	367	368	375	NS
1974/75:						
Start	kg	474,0	475,9	473,0	475,4	NS
End	kg	487,2	500,1	487,6	479,1	NS
Difference	kg	13,2	24,2	14,6	3,7	
Significance		NS	NS	NS	NS	
Recalving	%	73,3	93,8	93,8	93,8	
Intercalving period	days	359	362	373	364	3 > 1
1975/76:						
Start	kg	408,8	413,1	425,1	424,2	NS
End	kg	427,5	455,1	469,2	465,1	2,3,4 > 1
Difference	kg	18,7	42,0	44,1	40,9	
Significance		NS	< 0,05	< 0,05	< 0,05	
Recalving	%	64,7	70,6	70,6	94,1	
Intercalving period	days	364	372	360	369	2 > 3

Start = Start of experiment
End = End of experiment
Difference = Difference in mass

The data on intercalving periods is deceptive as the cows receiving minerals only, returned similar or better intercalving intervals than the other groups while in fact, they produced the poorest reproductive performance (Table 3). This anomaly is illustrated in the histogram (Fig. 1) where the cumulative percentage of cows calving during ten day periods, commencing at the beginning of the calving season, is presented for the four groups. The figure shows that approximately 92 per cent of the cows receiving protein and energy supplements had calved within 30 days of the onset of the calving season while only 75,7 per cent and 82,5 per cent had calved during the same period in the Control and NPN supplemented groups (Fig. 1).

The CP, Ca and P content of grass samples collected manually from the experimental site over a 12 month period is persented in Table 4. The analyses indicated a pronounced change in CP content of the sward over the 12 months. An arbitrary division of the period into the four seasons, indicated that the CP content varied from 5,9 per cent in summer to 3,8 per cent in winter. The average Ca and P content of the samples showed no great variation over the period studied and the resulting averages were 0,17 per cent and 0,11 per cent for Ca and P, respectively (Table 4).

Discussion

The results of this trial demonstrate the beneficial effects which protein and energy supplementation can have on the lactating cow during a 100 day period *post partum*. The superior reproductive performance of the cows supplemented with energy, agrees with the results of Macfarlane, Somerville, Lowman & Deas (1977), Wiltbank *et al.* 1964) and Speth, Bohman, Melendy & Wade 1962).

Results

The intakes of the protein and energy supplements (supplements 3 and 4) were disappointingly low during the 1973/74 season (Table 2). This can be attributed largely to the supplements being spoiled by rain as uncovered containers were used. In subsequent years the troughs were supplied with covers. If the intakes of supplement for the first year are disregarded, the average intakes would be 201 g, 344 g, 913 g and 797 g per cow per day for Groups 1, 2, 3 and 4, respectively.

Table 2

Average intake of supplement, CP, TDN, Ca and P per cow for the four supplemented groups

	Control	Supplement: Plus NPN	Plus protein	Plus energy
Intake of supplement (g/cow/day)				
1973/74	145	280	414	334
1974/75	172	290	801	692
1975/76	230	398	1024	902
Average intake of supplement●	201	344	913	797
Average feed intake●				
CP	4,0	162,0	449,2	51,0
TDN	--	93,6	346,9	382,6
Ca	40,0	20,6	65,7	35,9
P	18,5	9,6	27,4	17,5

●1973/74 intake of supplements excluded

The cows which received the energy-rich supplement (supplement 4) consistently produced the best reproductive performance followed by those cows receiving NPN and protein (supplements 2 and 3). These two treatments produced results which followed the same pattern during different seasons (Table 3). The average recalving percentages over the three seasons for the cows receiving supplements 1, 2, 3 and 4 were 73,1 per cent, 85,8 per cent, 85,8 per cent and 96,0 per cent, respectively. In the first and third seasons, the cows in Group 1 did not show significant increases in mass from the beginning to the end of the experimental period, whereas the breeding females in the other three groups were significantly heavier ($P < 0,05$) at the end than at the beginning of the experiment. Due to a shortage of Sussex bulls, some groups were mated to Drakensberger bulls in the second and third seasons. Data on the weaning mass of the calves is therefore available for one season only There was no significant treatment effect on the weaning mass of the calves, but a tendency for the calves from the protein and energy-enriched groups (supplements 3 and 4) to wean heavier than those from the Control and NPN supplemented groups (supplements 1 and 2) was evident (Table 3).

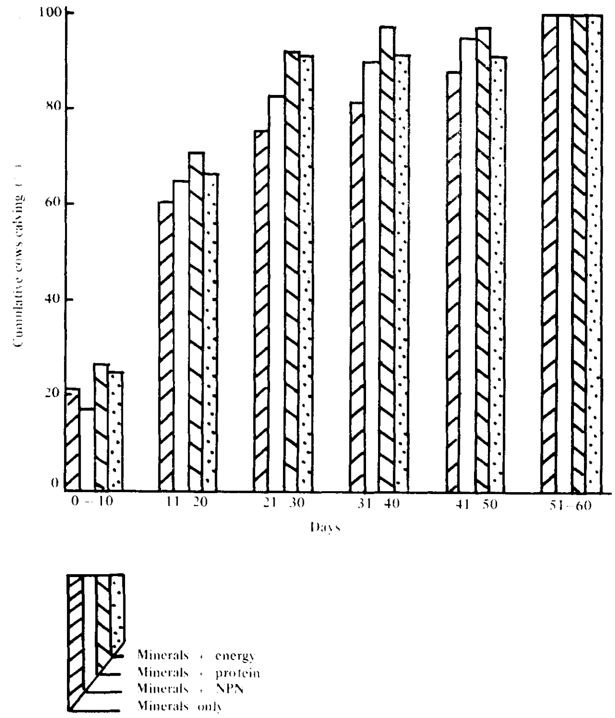

Fig. 1 *Cumulative percentages of cows calving in ten day increments from the beginning of the calving season for the four supplemented groups*

Table 4

Crude protein, calcium and phosphorus content of grass samples collected over 12 months from the experimental site

Month	CP (%)	Ca (%)	P (%)
December	7,30	0,17	0,11
January	5,67	0,19	0,10
February	4,66	0,18	0,15
March	4,48	0,16	0,12
April	4,24	0,20	0,11
May	3,88	0,16	0,09
June	3,35	0,15	0,07
July	4,27	0,17	0,11
August	3,77	0,15	0,09
September	4,66	0,15	0,10
October	5,17	0,16	0,13
November	7,19	0,18	0,11
Summer (December January February)	5,88	0,18	0,12
Autumn (March April May)	4,20	0,17	0,11
Winter (June July August)	3,80	0,16	0,09
Spring (September October November)	5,67	0,16	0,11

In order to assess the results of this trial in terms of satisfying nutrients requirements it was necessary to investigate the capacity of the veld to supply the suggested requirements for the lactating beef cow. The chemical analyses of the grass samples collected during the summer months from the area grazed, revealed that the average CP, Ca and P contents were 5,9 per cent, 0,18 per cent and 0,12 per cent respectively (Table 4). If it is assumed that a 450 kg lactating beef cow consumes approximately 9,5 kg DM per day through grazing during summer (NRC, 1976), such a cow will ingest 560 g CP, 17 g Ca and 11 g P which represents 65 per cent, 65 per cent and 42 per cent of the daily requirements of a lactating beef cow for CP, Ca and P (NRC, 1976). Furthermore, if the TDN content of summer veld is estimated at 48 per cent (Bredon, 1976), the cow will consume 4,5 kg TDN per day, or 90 per cent of the TDN requirements (NRC, 1976). From the above analyses and assumptions it would appear that lactating beef cows on veld similar to that grazed during the experiment will suffer from severe P, moderate to severe CP and Ca, and slight TDN deficiencies during the summer months. The CP deficiency may be merely theoretical as Bredon, Lyle & Swart (1970) suggested that the forage selected by cattle contained a higher percentage of CP and lower percentage of CF than indicated by analysis of clipped samples. They concluded that the difference in CP between grazed and clipped herbage was of the order of 25 per cent. Thus, from a theoretical point of view, it appears that lactating beef cows should be able to satisfy the majority of their nutritional requirements, except P, from veld grazing. However, the performance of the animals in this trial was not in keeping with this hypothesis since the cows receiving TDN or protein supplements consistently exhibited better reproductive performances than those cows receiving only mineral supplementation.

The difference in calving percentage between the Control group and the cows receiving the energy-rich supplement may be attributed to the effect of energy supplementation. The difference between the groups receiving the protein- and energy-rich supplements appear to be due to biological variation as both groups received virtually the same amount of TDN. On the other hand, the cows receiving NPN equaled the production of the cows in the protein supplemented group, but received far less CP and TDN than the cows in the latter group (Table 2). This phenomenon may have been due to the stimulatory effect of NPN supplementation on the activity of the rumen microflora which in turn stimulated a greater grass intake.

The exact reason for the increase in reproductive performance due to supplementation is not clear, but appears to be primarily due to energy supplementation, with protein supplementation being of lesser importance. The limitations of field experiments of this nature are clearly borne out by the difficulty encountered in interpreting the results and further studies should be carried out in order to establish the mechanisms which control the responses observed.

When the economic implications of this experiment were analysed, the results indicated that the cows receiving the energy-rich supplement returned the highest gross margin above cost of supplementation (R66,99 compared with R51,58 for cows receiving the protein-rich supplement). This was due to the cows having attained the highest reproductive rate at a relatively low cost (9,9c per kg) of the supplement per cow. On the other hand, the cows which received the protein supplement produced a favourable reproductive performance, but the high cost (16,8c per kg) of the supplement reduced its profitability. Hence, the latter group produced the poorest gross margin of all four groups. By continuing with the winter lick (NPN) until the end of the breeding season, and with a relatively low cost of supplementation, the gross margin for the cows supplemented with NPN (R62,96) compared favourably with the gross margin for the cows receiving energy. Except for supplementation with a natural protein, it was concluded that energy or NPN supplementation is a profitable practice.

Acknowledgement

The authors are greatly indebted to Mr. R.K. Scott for assistance as regards management of the trial, Mrs. M. Smith for statistical analysis of the results and the laboratory staff under Mr. S.F. Lesch for the chemical analysis of the grass samples.

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