ROLE OF NUTRITION IN BEEF CATTLE PRODUCTION

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Introduction

Increased beef production in the Republic has become an issue of considerable National importance demanding a bold approach by producers and agriculturists alike. With a projected deficit of no less than 500 000 carcasses by 1980 and an estimated target of at least 5 million carcasses per annum by the year 2000 it has become imperative that the production tempo be increased.

The major problem facing the beef industry throughout the world, and in the Republic in particular, is one of inadequate supplies of the basic raw material — the weaner calf. An increase in the supply of weaner calves can be achieved through three major avenues, namely

(a) increasing the proportion of effective breeding cows in the National herd,

(b) increasing the output of calves per 100 cows, and

(c) increasing the total number of effective breeding cows in the production areas.

If an increase in the production tempo is to be achieved in these major areas there must be the necessary incentive to the producer through an improved profit position. It is the purpose of this paper to consider the importance of nutrition in generating improved profit equations for the intensification of beef production.

Importance of cowherd in relation to the beef cycle

In developing improved profit equations for beef production, emphasis must inevitably fall on the cowherd. Apart from its obvious role of supplying the basic raw material it is also the phase of the production cycle utilising the bulk of the total feed input. This fact is not generally appreciated by producers and researchers who have tended to give major emphasis to the slaughter animal. The partitioning of the total digestable nutrients (TDN) requirements to the various phases of the production cycle is summarised in Table 1.

TABLE 1 Partitioning of TDN for the beef production cycle

Phase	kg TDN/unit	Percentage of total
1 Rearing of replacements	1136	16
2 Maintenance of cow and calf to weaning	1820	52
3 Fattening weaners	1136	32

In view of the fact that approximately 70 per cent of the total TDN requirements for beef production are required by the breeding herd to raise a calf to weaning, attention in this discussion will be directed at nutritional considerations as they affect the cowherd.

Nutrition of the beef cow

Conceptually, the gross energy from feed consumed by the beef cow can be divided into parts utilised for maintenance of body mass, growth and the production of animal production. Knowledge of the amounts of feed required for each use are important for business decisions relating to the economic consequences of feeding and management strategies. Recent work by Hohenbroken, Hauser, Chapman & Cundiff (1972) has partitioned lactation TDN consumption by Hereford cows and these results are summarised in Table 2.

Feeding strategies directed at increasing productivity of the cowherd are primarily concerned with

(a) stepping up the number and mass of weaner calves per 100 cows at a reduced cost per breeding unit, and

(b) enabling a larger number of cows to be carried per unit area.

Breeding seasons have normally been applied to take advantage of the most favourable environment for the production cycle. Equating the demand for nutrients by the animal and the supply of feed or 'fodder-flow' is a basic consideration in the formulation of effective production strategies.

Optimum reproductive performance is a function of

(a) early onset of estrus,

(b) conception at first service and

(c) minimising losses at or soon after calving.

TABLE 2 Partitioning of lactation TDN consumption in Hereford cows

Partitions of lactation TDN	Percentage TDN
Maintenance	73
Mass gain	6
Milk production	21

The importance of nutrition and particularly the energy level on the interval from calving to first estrus is well documented. A low level of energy before and after calving lengthens the interval from calving to first estrus. (Wiltbank, Rowden, Ingalls, Gregory & Koch, 1962; Dunn, Ingalls, Zimmerman & Wiltbank, 1969). This is particularly pertinent in the case of young cows. If a high proportion of young cows are to show estrus by 60 to 80 days after calving they must receive adequate levels of energy prior to calving. Wiltbank has shown that on low TDN levels after calving only 80 per cent of cows cycled compared to 97 and 98 per cent respectively for cows on the medium and high energy levels.

The effect of nutrition on conception rate at first service has also been demonstrated by Wiltbank and it is generally accepted that cows should be on a rising plane and gaining in mass after calving for optimum conception rates.

Emphasis in this discussion has been placed on energy since this is the priority nutritional consideration in practise in the beef herd. It should be stressed however that the requirements for protein during the production cycle follow the same pattern as energy. Of considerable importance in the feeding of protein to beef cows is the recent experimental evidence by Bond & Oltjen (1973) that two thirds of the protein in the diet of beef females could be supplied by urea without adversely affecting reproduction or production.

Various workers have demonstrated the importance of the pre-calving level of nutrition on both calf losses at birth and subsequent milk production. Turman (1964) has shown that first-calf heifers, poorly wintered so that they lost 20 per cent of their autumn mass, gave only 80 per cent of the milk flow of properly nourished heifers even though ample pasture was available during the summer. This resulted in a reduction of nearly 25 per cent in calf weaning masses. It must be stressed that heifers fed excessively also lactated poorly, indicating that extremes will damage the performance of young beef heifers during this sensitive period. Both too low and too high levels of nutrition can be extremely detrimental, and calving difficulty is greatly increased in fleshy overfat heifers and cows.

Recent research results from the Oklahoma Group (Pinney, Stephens & Pope, 1972) on lifetime performance of beef females fed different levels of winter supplemental feed have stressed the importance of avoiding overfeeding dry cows. Cows fed at 60 per cent NRC (National Research Council) levels during winter standard weaned 340 and 478 kg more calf than the average cow on the medium (120 per cent of NRC) and high (200 per cent of NRC) winter levels respectively.

The effect of feeding conditions on calf growth to weaning has been well established and since already at four months the calf obtains over 60 per cent of its nutrients in the form of grazing or forage, the availability of forage at this stage is vital for optimum calf growth.

It is therefore evident from this brief resumé that nutritional considerations particularly just prior to and after calving play a vital role in optimising output from the cowherd. Optimum calving strategies must equate the requirements of the cow and calf to the 'fodder-flow' and must consider the factors mentioned.

Increasing the quantity and quality of forage per unit area

In view of the necessity for an increase in both the output per 100 cows and the total number of cows in the Republic it is vital that attention be directed at improved forage systems for beef cows. Fortunately some encouraging facts have emerged from recent research which include the following:

(1) Promising results with various radical veld improvement techniques in the Highland Sourveld from the research of Dr E P Theron and his team in Natal.

(2) A better understanding of the potential of *Eragrostis curvula* for both hay and grazing in the Eastern areas of the Republic.

(3) Promising results with the integration of star grass and veld fertilisation in the Tall Grassveld areas of Natal.

(4) Marked increases in herd productivity from the effective utilisation of annual forage crops (particularly maize silage) for winter feeding.

(5) Promising results from preliminary research on the replacement of natural vegetation with *Cenchrus ciliaris* in the extensive ranching areas of the Transvaal.

(6) Encouraging early results with veld fertilisation and oversowing from FSSA projects in various parts of the Republic.

The biological and economic potential of various pasture intensification techniques developed by Dr E P Theron and his team were recently assessed by Harwin & Lombard (1974). While these results are specifically for the Highland Sourveld area of Natal they provide a useful indication of the prospects for the economical intensification in beef cowherds in the Eastern High rainfall areas. The results of this analysis together with a resumé of the reference material and basic assumptions is summarised in Table 3.

It is evident from Table 3 that the various radical veld improvement techniques involving both partial and total veld replacement offer tremendous potential for increased calf production both per animal and per unit area. The substantial increase in calf mass per unit area is associated with a dramatic improvement in the profit position. These conclusions are based on the synthesis of early research results on a relatively small scale and must be considered as only indicative of potential. There seems little doubt, however, that this analysis emphasises the tremendous scope for economic intensification of beef production in the high rainfall eastern areas of the Republic.

TABLE 3 Potential of various pasture intensification systems in the Highland Sourveld (1)

	Stocking rate per annum MLU	Grazing duration (days)	Forage cost (R) per ha	Cost/Cow per annum (R)	Calf growth ADG	Percentage calves weaned	Calf mass per ha (kg)	Total mass per ha (kg)	Margin per cow (R)	Margin per ha (R)
	(2)		(3)	(4)	(5)	(6)		(7)	(8)	(8)
Veld (4 camps)	,41	180	27,5	98,25	,82	80	32,5	50,7	−14,8	−4,2
Veld (8 camps)	,60	200	35,3	86,12	,86	80	53,7	79,5	4,9	1,9
Fert/Fortified veld	1,78	220	95,7	71,92	,86	85	203,5	272,5	32,1	38,1
Kikuyu	2,26	230	98,9	59,24	,91	85	278,2	376,0	56,5	82,8
Grass/Legume (dry)	2,11	190	88,9	53,21	1,0	85	256,6	344,9	56,4	79,5
Grass/Legume (ir)	3,02	270	87,5	37,56	1,0	90	520,5	646,3	109,3	220,0
Intensive Pasture (9) (ir)	5,00	365	251,8	75,60	1,0	90	743,9	1068,8	74,2	247,1

(MLU = mature livestock unit; ADG = average daily gain)

(1) Synthesis of available experimental data of Dr E P Theron and team by Harwin & Lombard (1974)
(2) Includes summer pasture and area required for winter feed production (maize silage)
(3) Based on actual costings from experiments. Land values were taken at R200/ha for veld and R250/ha for area under pastures. Interest rate of 9 per cent. Fencing costs at R250/kilometer including gates plus 10 per cent labour. Estimated cost of R17,40/ha and R26,55/ha for 4 and 8 camp systems respectively.
(4) Includes both summer and winter feed costs only — other fixed and variable costs are not included.
(5) Based on Tabamhlope project. (Theron, *et al*). Simmentaler cows with Hereford cross calves.
(6) Assumptions necessary in the case of intensive pasture systems.
(7) Includes salvage mass of cow (17 er cent replacement rate) based on Tabamhlope experimental results.
(8) Margin over feed costs based on 50c/kg for weaner calf and 36c/kg livemass of cow.
(9) Production and costing data based on Report of Sub Enterprise Systems team. (Heard & Wiseman, 1973).

It may be argued that these techniques have limited impact in terms of the 'National Scene' since less than six per cent of European farmland in the Republic falls in this high potential zone. The distribution of both ecological areas and livestock in the Republic is summarised in Table 4. It is evident from Table 3 that a threefold increase in carrying capacity in the Eastern high potential area would be equivalent to a 50 per cent increase in carrying capacity in the Bushveld/SWA area. It is submitted that a threefold increase in carrying capacity in the higher rainfall areas appears a more likely attainable goal from both a biological and economic standpoint.

TABLE 4 Relative areas and livestock population of different ecological areas (1967/68 census)

Area	Area as % of total	Livestock population as % of total	Stocking rate ha/MLU
Karoo	45,98	21,08	16,92
Bushveld/SWA	32,15	31,08	8,02
Central grassveld	12,35	27,69	3,46
High potential	5,77	15,69	2,86
Winter rain	3,73	4,45	6,51

Souce: Institute for Crops and Pastures

Relative importance of improved forage production strategies to management and breeding strategies

Quite obviously a holistic approach to intensification of the cowherd is necessary in which breeding management and feeding strategies are integrated and optimised. Improved feeding conditions must be matched with superior breeding stock and improved management strategies and all must advance together.

Various management, genetic and nutritional strategies directed at increasing the productivity of the beef cowherd were recently reviewed by Harwin & Lombard (1974) and an attempt was made to quantify their potential impact on the level of herd productivity. These findings are summarised in Table 5 merely to serve as a basis for future planning.

While the assessment of potential increase in productivity presented in Table 5 is obviously an over-simplification and must not be misconstrued, the potential impact of improved forage systems is indeed dramatic. Various radical veld improvement techniques can increase herd productivity by many hunderds of per cent.

TABLE 5 *Potential for increasing 'herd productivity' of various strategies*

Technique/factor	Potential increase in productivity (%)
Herd Management/Nutrition	
Breeding season	25%+
Age of first calving	12%+
Age of culling	up to 25%
Early weaning	15%+
Multiple suckling	25%+
Genetic Factors	
Breeds	5–10%
Breeding system	10–15%
Selection	
– Continuous and Permanent	*ca* 2% per annum
Improved Forage Systems	
Pasture management	33%+
Integration of winter conserved forage	20%+
Pasture type intensification (dryland)	up to 380%
Pasture type intensification (irrigation)	500-700%

Summary and Conclusion

Nutritional consideratinos deemed to be pertinent to increasing productivity in the National beef herd have been discussed. It has become very apparent from this discussion that improved forage systems directed at increased production and utilisation of roughage by the beef cow herd are the key to increasing the production tempo.

In terms of future business decisions by both producers and agriculturists there seems little doubt the priority attention must be directed at pasture intensification techniques in the high rainfall areas of the Republic. The improved utilisation of annual fodder crops (maize) is included in this context. The future prospects for increased production are excellent since intensification can be associated with increased profits.

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