Review

Animal production from native pasture (veld) in the Free State Region – A perspective of the grazing ruminant

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The seasonal variation in diet selection and herbage intake of cattle and sheep and the effects on animal performance at various research centres are put into perspective, taking into consideration the annual rainfall and its distribution. The most important constraint on animal production from pastures, appears to be an insufficient intake of digestible nutrients in relation to animal requirements, which may at times be aggravated by deficiencies of specific nutrients in the herbage. Supplementary feeding may increase the nutrient intake of grazing ruminants and correct deficiencies in pastures. However, despite considerable costs incurred, animal response to supplementation can at best be described as unpredictable and far less than might be expected from feeding standards. Renewed efforts towards gaining a more comprehensive understanding of, and explanation for, the interactions between the integrated animal/plant biological system of grazing conditions, are discussed.

Seisoenale wisseling in dieetseleksie en weidinginname deur beeste en skape asook die invloed daarvan op diereprestasie by verskeie navorsingsentrums word, binne die raamwerk van verskille in jaarlikse reënval sowel as verspreiding, in perspektief geplaas. Die grootste beperking wat op diereprestasie vanaf veldweidings geld, is klaarblyklik 'n onvoldoende inname van verteerbare voedingstowwe in verhouding tot voedingsbehoeftes, wat soms vererger word deur 'n tekort aan spesifieke voedingstowwe in die weidings. Aanvullende voeding mag die voedingstofinname van weidende herkouers verhoog en tekorte in weidings vir diereproduksie regstel. Ten spyte van aansienlike kostes daaraan verbonde, is die responsie egter wisselvallig en aansienlik minder as wat vanaf voedingstandaarde afgelei kan word. Hernieude pogings ter bereiking van 'n omvattender kennis en begrip van die interaksies tussen die geïntegreerde dier/plant biologiese sisteem wat onder weidingstoestande heers, word bespreek.

Keywords: Animal performance, DM production, diet selection, feed intake, native pasture (veld), supplementation.

Introduction

An estimated 68,4 million ha veld (native pasture), or 80% of the land available in South Africa for agricultural purposes, can only be effectively utilized by grazing ruminants. The South African veld types are extremely diverse in terms of botanical composition (Acocks, 1975), dry matter (DM) production potential and therefore nutritive value (*i.e.* ability to sustain animal production). Furthermore, large variations in DM yield of veld, primarily due to differences in annual rainfall as well as its distribution, occur at any specific site between years and are invariably reflected in animal performance. The grazing ruminant therefore exists in a highly dynamic situation where its performance in terms of growth, and milk and wool production, is determined not only by changes in nutrient requirements, but also by the physical environment as well as quantity and quality of available pasture (Reid & Jung, 1982). Although some of these factors may be manipulated by man to the advantage, or sometimes even disadvantage of animals, an important constraint on animal production from pastures remains an insufficient intake of digestible nutrients (Hacker, 1982; Hodgson, 1982). This may be compounded by deficiencies of specific nutrients, like phosphorus (Read, Engels & Smith, 1986b) or sodium (De Waal, Baard & Engels, 1989a; 1989b). Continuous overstocking and overgrazing have affected the DM production potential and stability of veld (Fourie, 1983) and, inevitably, animal production. Therefore, to maintain the livelihood of many South African farmers, efforts to stop the retrogression of veld condition and stability and to increase the utilization to that of its full potential should be considered as top priority (National Grazing Strategy, 1985, cited by De Waal, 1986). Despite a wealth of knowledge concerning ruminant nutrition, the considerable variability in animal performance observed in practice accentuates the need for a more comprehensive understanding of the nutritive value of veld and the integrated animal/plant biological system.

A long-term research programme, spanning the last two decades, was therefore launched at several research centres in the central Orange Free State and Northern Cape. This whole area, served by a subdivision of the South African Department of Agricultural Development, is known as the Free State Region and encompasses 21,7 million ha of which 18,4 million ha is veld. Results from this programme, conducted jointly by animal and pasture scientists, have broadened the knowledge and widened our perspective of various nutritional and environmental factors affecting grazing ruminants (Engels, 1972; De Waal, 1979; Fourie, 1983; Fouché, 1984; Read, 1984; De Waal, 1986). The relevant information gained from this programme is presented in this paper and will hopefully encourage a more informed perception of the situation.

Discussion

Rainfall, DM production and grazing capacity of veld

Rainfall decreases progressively from east to west across the subcontinent and particularly across the Free State Region. Furthermore, at a given site, rainfall varies between years and the incidence of years with below-average rainfall exceed those with higher-than-average rainfall. For example, during the period 1922 — 1986, the annual rainfall at Glen (near Bloemfontein) was less than the average for 57% of the years.

Consistency in distribution during the rainy season is of greater importance than the absolute annual rainfall. A comparison of the long-term average monthly rainfall (1922—1984) and that over a shorter period (1981—1984), as well as the marked variation in DM production of the veld, are presented in Figures 1 and 2, respectively. According to the average monthly rainfall recorded at Glen over a period of 62 years (Figure 1), *ca* 80% of the annual rainfall was received between October and April, *i.e.* during the active growing season. However, monthly

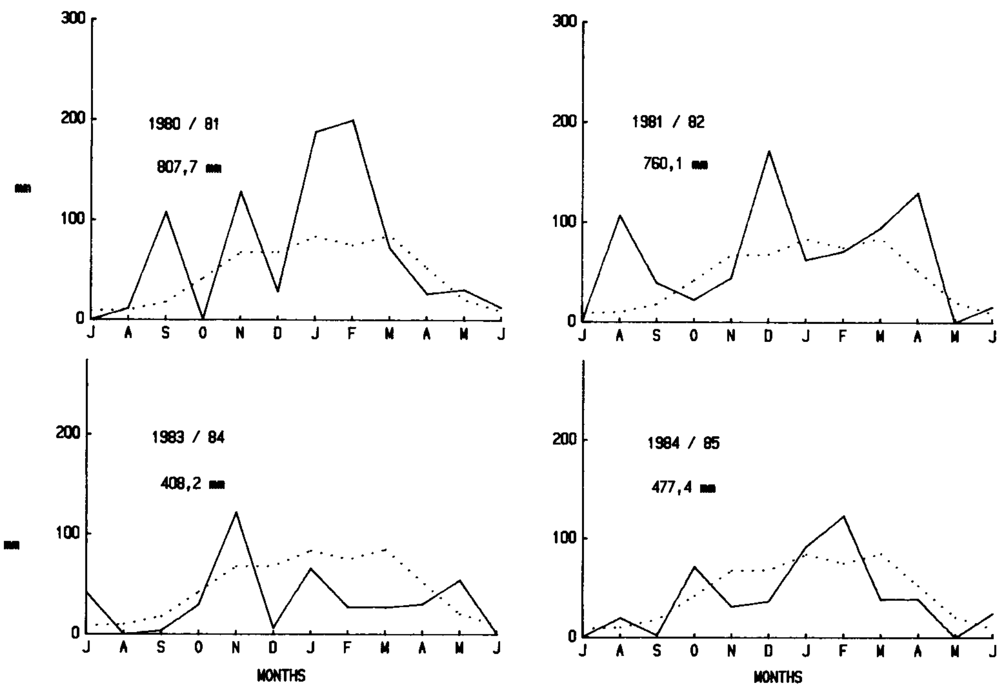

Figure 1 Monthly rainfall during the period 1980/81 to 1984/85 at Glen in comparison to the long-term average (1922—1984) monthly (...) and annual (537,6 mm) rainfall.

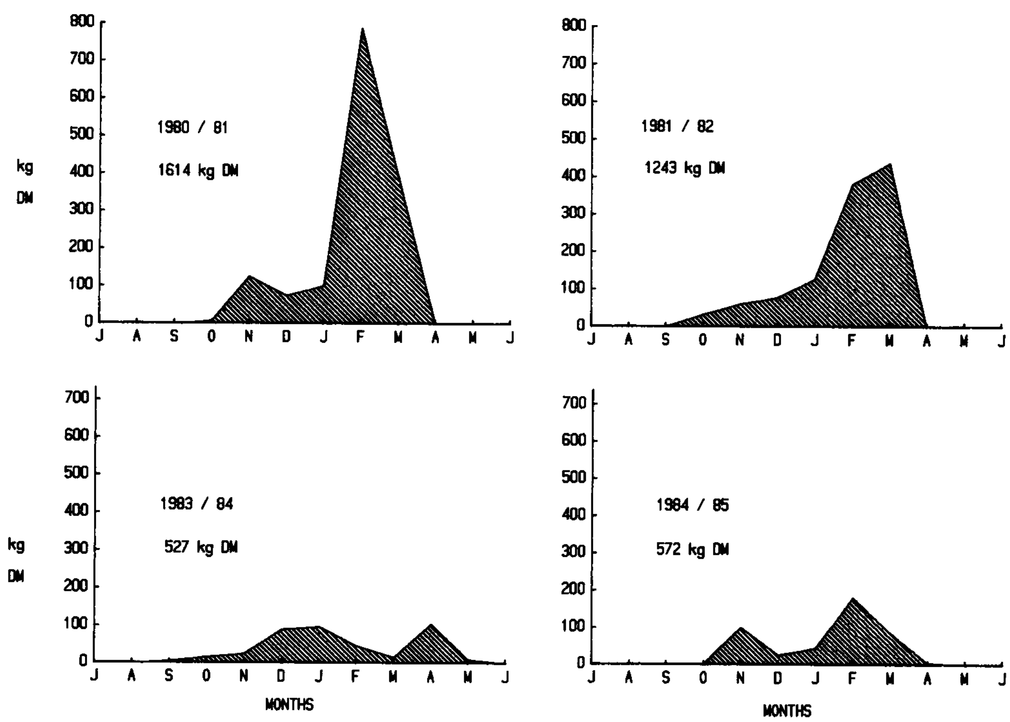

Figure 2 Monthly and annual dry matter production (kg DM/ha) of veld at Glen during the period 1980/81 to 1984/85.

DM yields during the last part of the growing season (Figure 2) usually exceeded those during the first part, with a distinct mid-summer low in DM yield during December/January in most years. The low and varying DM yields of veld early in the growing season (Figure 2) were often insufficient to maintain animal production and required DM reserves, carried over from the previous growing season.

Since these variations in rainfall and DM yields are typical of the Free State Region, the effect on animal performance of a three-fold difference in DM yield between successive years (Figure 2; 1614 kg *vs* 1243, 527 or 572 kg), should be a major consideration when determining realistic long-term grazing capacities and stocking rates. This forms the basic premise of the guidelines provided by the Department of Agricultural Development. For example, the suggested grazing capacities for veld at Glen, Armoedsvlakte (near Vryburg), Vaalharts (near Jan Kempdorp), Koopmansfontein (near Barkly West on the Ghaap plateau) and Massakloutjie (near Upington in the Kalahari) are respectively 6, 7, 9, 10 and 18 ha/Large Stock Unit (LSU) per annum. In a long-term trial with beef cattle grazing veld at Armoedsvlakte (Figure 3), Fourie (1983) studied the relationships between stocking rate (ha/LSU), production/ha and production/animal. This work demonstrated the necessity for adopting and adhering to the concept of optimum and *not maximum* animal production per unit area. Moreover, if stocked correctly (7 ha/LSU for Armoedsvlakte), sufficient herbage was available at the beginning of September to last the cattle for 300 days, without having to rely on any new regrowth of the veld. Conversely, if overstocked at 4 ha/LSU, the available herbage would only be sufficient for 70 days (Fourie, 1983). Considering the low and inconsistent DM yield during the first part of the growing season (Figure 2), the consequences for stable animal production are obvious. However, some producers, as well as other supposedly better informed operators, apparently do not yet realize the importance of these basic facts. In the past, lack of sufficient convincing experimental data prevented the general acceptance of this concept, but results of Fourie (1983), together with those of studies currently in progress at Glen, Armoedsvlakte and Koopmansfontein, should alter this. In the long run, optimal animal production can only be achieved and stability of veld maintained if realistic stocking rates are applied according to the grazing capacity of the veld. The suggested grazing capacities should not be regarded as constants. Ideally, stocking rates should be judiciously adjusted in the short term according to rainfall (both annual and distribution), DM yield and veld condition.

Quality of veld and diet selection

Seasonal trends in crude protein (CP) and digestible organic matter (DOM) content of the diet selected by oesophageally fistulated (OF) cattle and sheep on veld at various sites in the Free State Region, are well documented (Engels, Van Schalkwyk & Hugo, 1969; Engels, Van Schalkwyk, Malan & Baard, 1971; Engels, Baard & Malan, 1974a; Engels, Malan & Baard, 1974b; Engels & Malan, 1978; 1979; De Waal, Engels & Van der Merwe, 1980; Engels, 1983; Faure, Minnaar & Burger, 1983; Read, 1984; Faure, Minnaar & Burger, 1985; De Waal, 1986; De Waal *et al.*, 1989a). These seasonal trends for OF sheep (Figure 4) and cattle (Figure 5) at Glen, are remarkably similar to those obtained elsewhere in the Free State Region, e.g. with OF cattle at Vaalharts (Figure 6) and OF sheep at Koopmansfontein (Figure 7), and closely follow the rainfall pattern at each site. It is also well known that sheep are more selective grazers than cattle (Engels, De Waal, Biel & Malan, 1981; Read, 1984). Despite the usual decline in CP and DOM content of the veld during winter, cattle, and especially sheep, are still able to

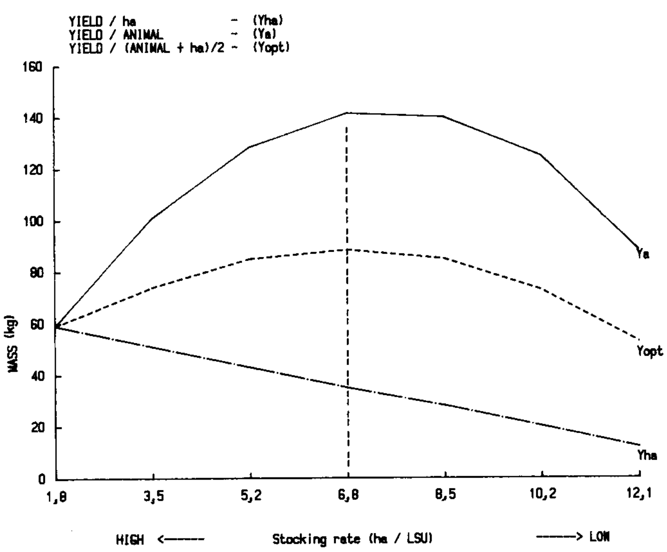

Figure 3 Relationships between stocking rate and animal production in terms of production/ha (Yha), production/animal (Ya) and optimum production (Yopt) (adapted from Fourie, 1983).

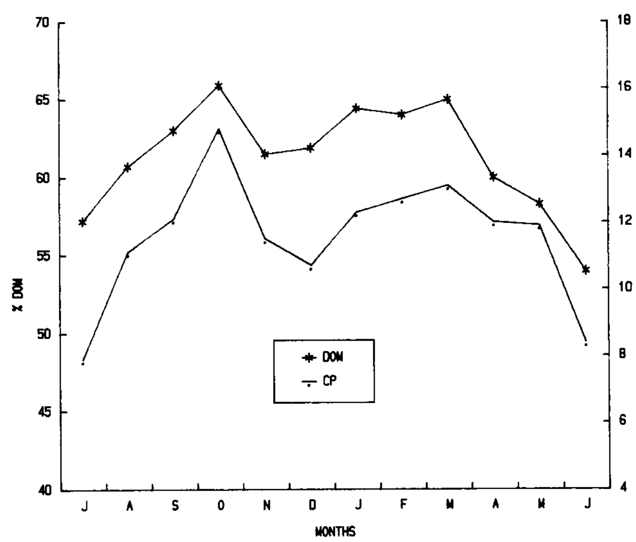

Figure 4 Seasonal variation in crude protein (CP) and digestible organic matter (DOM) content of veld at Glen as selected by oesophageally fistulated (OF) sheep (adapted from De Waal, 1979).

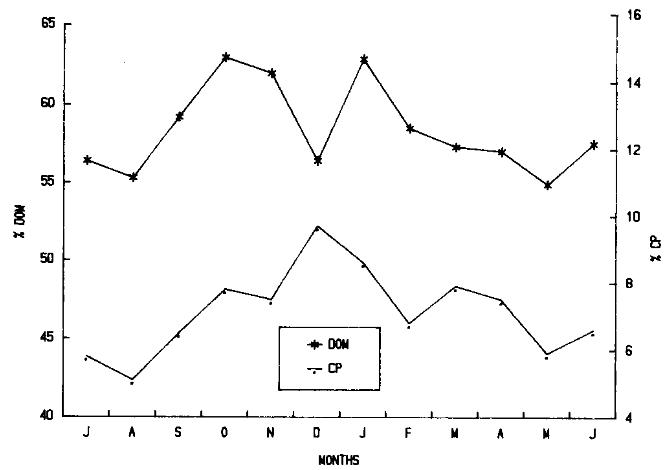

Figure 5 Seasonal variation in crude protein (CP) and digestible organic matter (DOM) content of veld at Glen as selected by OF cattle (De Waal & Blair, 1982 unpublished data).

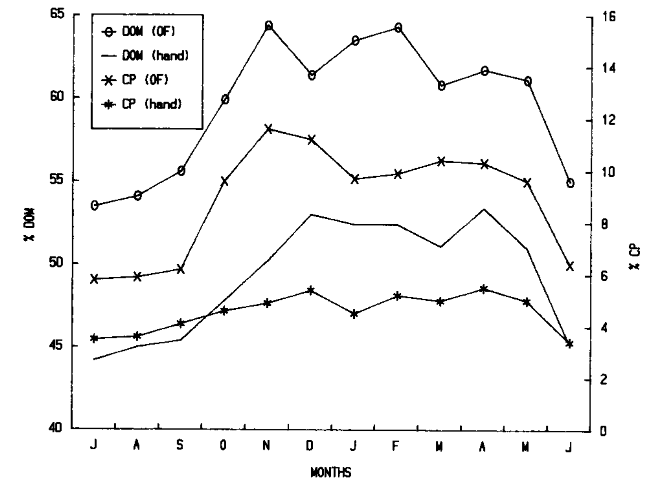

Figure 6 Seasonal variation in crude protein (CP) and digestible organic matter (DOM) content of veld at Vaalharts as sampled by hand or selected by oesophageally fistulated (OF) cattle (adapted from Engels, 1983).

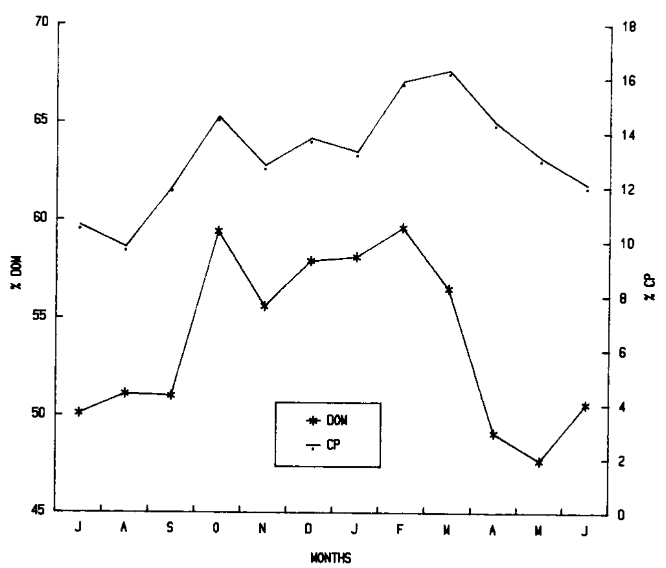

Figure 7 Seasonal variation in the crude protein (CP) and digestible organic matter (DOM) content of the veld at Koopmansfontein as selected by oesophageally fistulated (OF) sheep (De Waal & Engels, 1987 unpublished data).

select herbage with a fairly high quality. The inability of hand-cut samples to represent the diet selected by grazing sheep and cattle is also well known (Engels, 1972; 1983; Read, 1984; De Waal, 1986) and is demonstrated in Figure 6.

Since availability and quality of veld are subject to differences in annual rainfall and distribution, the CP and DOM content of the diet selected by animals at a specific site may differ considerably between and within seasons (De Waal, 1986). Differences in botanical composition and stocking rate may also affect results obtained in different studies at the same site (Engels *et al.*, 1969; De Waal *et al.*, 1980; Fourie, 1983; De Waal *et al.*, 1989a).

Despite these variations, the CP and DOM contents of the diet selected by grazing cattle and sheep are higher than those of hand-cut samples. Moreover, a basic premise in the evolution of, and the justification for supplementary feeding strategies, namely that grazing animals ingest herbage which is mostly of an inferior quality and deficient in several nutrients (Louw, 1969), is evidently erroneous.

Herbage intake by grazing ruminants

Although diet quality is important, production by the grazing ruminants is more dependent on the total intake of digestible nutrients (Hodgson & Rodriguez, 1971). According to Minson (1982), the amount of herbage ingested by grazing ruminants depends on the availability of acceptable herbage, the physical and chemical composition of the pasture and the nutrient requirements as well as the capacity of the animals to ingest herbage. Considering the quality of herbage selected by cattle and sheep (Figures 4, 5, 6 and 7), reasonable levels of animal production may be expected even during winter, provided that intake is not impaired nor that nutrient requirements imposed by physiological status (growth, lactation) are too high. Engels & Malan (1978) showed that the herbage intake by Merino wethers on veld at Glen was barely sufficient to meet maintenance requirements during winter, even though the CP and DOM content of the diet appeared to be satisfactory. Similar results were obtained with young Merino and Dorper wethers (De Waal, Engels, Van der Merwe & Biel, 1981) and young Merino wethers (De Waal *et al.*, 1989a). In trials by De Waal *et al.* (1980; 1981), the monthly diet selection, herbage intake and body mass changes of Dorper and Merino wethers were studied for one year (Table 1).

Herbage intake was considerably higher than the maintenance requirements (33,5 g DOM/W$kg^{0,75}$/d; Engels, 1972), except for April, May, June and July when maintenance requirements were barely satisfied. Furthermore, the response in body mass changes of the wethers lagged behind the observed sharp increases in CP and DOM content of the diet and herbage intake during spring. There were notable differences in intake and body mass changes between the two breeds (see Table 1).

Table 1 Monthly diet selection (CP and DOM content), herbage intake (g DOM/Wkg^{0,75}/d) and body mass of Dorper and Merino wethers on veld at Glen (adapted from De Waal *et al.*, 1980; 1981)

Month	CP[a] (%)	DOM[b] (%)	g DOM/Wkg^{0,75}/d		Body mass (kg)	
			Dorper	Merino	Dorper	Merino
June	8,4	54,0	35,8	35,1	34,7	31,8
July	7,9	57,2	38,0	43,0	34,9	31,2
August	11,1	60,7	50,4	60,0	35,2	31,0
September	12,1	63,0	51,4	50,4	38,0	33,1
October	14,8	65,9	49,8	55,0	41,0	36,6
November	11,5	61,5	43,2	52,0	44,1	37,9
December	10,3	61,9	44,0	49,9	46,3	40,4
January	12,3	64,4	53,1	55,3	50,6	43,1
February	12,7	64,0	41,7	47,1	52,5	45,1
March	13,1	65,0	43,8	46,5	55,2	47,1
April	12,0	60,0	34,2	38,3	58,6	50,1
May	11,9	58,3	32,6	36,1	58,5	49,2

[a] Crude protein content.
[b] Digestible organic matter content.

Owing to higher nutrient requirements, lactating ewes are more likely to be affected by an inadequate nutrient intake, resulting in a severe loss of body condition. This is especially true during winter, as demonstrated with lactating Merino and SA Mutton Merino ewes (Engels & Malan, 1979) and Merino and Dorper ewes (De Waal, 1986) at Glen and lactating Dorper ewes at Koopmansfontein (De Waal, Engels, Terblanhcé, Malan & Baard, 1987 unpublished data). Lactating ewes require an intake of at least 55 g DOM/Wkg^{0,75}/d on veld (De Waal, 1986) to achieve and maintain satisfactory levels of production (*i.e.* good growth rates by lambs and a minimum loss of body condition of the ewes). However, in studies at Glen (De Waal, 1986; De Waal & Combrinck, 1987 unpublished data), lactating Merino and Dorper ewes consumed only 20—30% more herbage during winter than non-lactating ewes. Furthermore, lactating ewes suffered severe losses of body condition, while non-lactating ewes were able to maintain body condition. When acceptable herbage is limited or sparsely distributed, sheep and cattle can extend their grazing time to a limited extent in an effort to increase herbage intake (Allden & Whittaker, 1970; Fourie, 1983), or at least maintain an adequate level of intake. Evidently, the lactating Merino and Dorper ewes were unable to increase intake sufficiently during winter, even though herbage was abundantly available. Their intake was therefore still insufficient to satisfy the high demand for nutrients posed by lactation (De Waal, 1986). However, it appears that, by changing from an autumn to a spring lambing season, lactating ewes could more easily satisfy their requirements from veld and the lambs also derived benefit directly from the better grazing conditions during summer (De Waal, 1986; De Waal & Combrinck, 1987 unpublished data). Although cattle may also occasionally have difficulty in satisfying their nutrient requirements from veld, this is neither as frequent nor as severe as with sheep, especially woolled breeds like the Merino.

The poor digestibility of veld during winter has often been implicated as a major cause of a decreased feed intake. However, Read (1984) stated that ' During 1982, towards the end of the summer growing season *i.e.* March, the cattle at Glen consumed 75,56 g DOM/Wkg^{0,75}/d with (an) OMD of 59,32%, which dropped to 34,16 g DOM/Wkg^{0,75}/d during August, at the end of winter just prior to the emergence of new spring growth, when the OMD was 55,50%. Clearly this 7% decrease in OMD could not account for the total drop of 55% in DOM intake'. Essentially similar observations and conclusions were made by De Waal (1979). Results obtained at Glen with the artificial fibre-bag technique (De Waal, 1986) showed that the rate at which herbage was fermented in the rumen of grazing ewes during winter was considerably slower than in summer (26 and 49% of DM disappeared/24 h, respectively). In each case, the herbage was collected from OF sheep, seven days prior to being incubated *in sacco* in the rumen. Seasonal changes in the composition of structural carbohydrates of the herbage (*i.e.* cellulose, hemicellulose and lignin), which are relatively resistant to microbial breakdown, appear to be very effective in extending the retention time within the reticulo-rumen. This, together with the effect of selective grazing behaviour of ruminants (Arnold & Dudzinski, 1978), reduce intake (De Waal, 1986). These aspects are currently being investigated.

Recently, the research programme of the Free State Region has been extended to include detailed investigations of some of the long-term effects of stocking rate. Overstocking increases competition for available herbage, which invariably affects animal performance (Cowlishaw, 1962; Sumner & Wickham, 1968; Langlands & Bennett, 1973; Fourie, 1983). In spite of an increase in time devoted to selecting and harvesting acceptable herbage (Allden & Whittaker, 1970; Fourie, 1983), compensation is incomplete, resulting in a decline in intake and animal performance. Preliminary results concerning the availabilty of DM, diet selection and herbage intake of young steers at Glen (De Waal & Venter, 1986 unpublished data), illustrate the marked effects which three different stocking rates have had on these parameters (Table 2). The implications are even more alarming, considering that the results were visible barely six months after the trial had commenced and that the different stocking rates were applied to veld which had previously been in a stable and good condition.

Supplementation of ruminants on veld

Supplementation may increase the nutrient intake of grazing animals, as well as correct deficiencies of pastures for animal production (McClymont, 1956). Although the latter has recently been demonstrated with supplementary P given to cattle at Armoedsvlakte (Read *et al.*, 1986b), the general response to supplements is unpredictable and usually far poorer than

Table 2 Available DM, diet selection and herbage intake of young steers at three stocking rates on veld at Glen during July 1986 (De Waal & Venter, unpublished data)

Effective stocking rate ha/LSU/ann.	Available herbage kg DM/ha	Diet selection		Herbage intake	
		CP[a] (%)	DOM[b] (%)	OM[c] g/d	DOM g/d
1,7	89	7,2	56,3	3853	2170
4,1	339	5,9	62,0	5273	3267
6,3	515	6,3	64,6	5799	3748

[a] Crude protein content.
[b] Digestible organic matter.
[c] Organic matter.

expected (De Waal *et al.*, 1980; 1981; De Waal, 1986; De Waal *et al.*, 1989a). Earlier studies concerning the nutritive value of veld in South Africa were based on the chemical analysis of hand-cut herbage samples (Du Toit, Louw & Malan, 1940). These data, and other subsequent reports, gave rise to the misconception that the herbage quality ingested by grazing ruminants is generally low and deficient in several nutrients and that supplementation is therefore required to support reasonable levels of animal production (Louw, 1969; 1979). This, together with results from conventional feed intake and digestibility trials, were used to develop the basic principles of supplementary feeding strategies (Coetzee, 1969; Louw, 1969; 1978; 1979) for ruminants grazing vastly different veld types, despite the fact that '... the diet of animals at pasture may differ substantially in quality, quantity and pattern of intake from that of similar animals given herbage harvested from the same pasture, consequently there may be quantitative differences between these two dietary regimens in the rate and extent, and hence, outcome of digestive processes' (Corbett & Pickering, 1983). The nutritive value of veld and, moreover, its ability to support animal production, as well as the role of supplementary feeding in promoting animal production, should therefore be studied under realistic and practical grazing conditions. Needless to say, any input regarding supplementation must be positively reflected in animal performance and the increase in output must be economically justifiable.

Despite claims that so-called 'rumen-stimulating' supplements increase both feed intake and digestibility of low quality roughages (Louw, 1978), De Waal *et al.* (1980; 1981) concluded that differential supplementation of protein (fish-meal) and P evinced no consistent trends with respect to either diet selection, feed intake or body mass changes of Merino and Dorper wethers on veld at Glen. In spite of this, they cautioned against extrapolation of the results to grazing conditions differing widely from those present in their studies, as this could lead to unrealistic recommendations. Moreover, lactating ewes have higher nutrient requirements than non-reproducing sheep and may therefore respond differently to supplementation. In subsequent trials, De Waal (1986) studied the effects of supplementary energy and/or crude protein (0, 100 or 200 g ground maize/d with or without 36 g CP/d) introduced via rumen fistulae to lactating Dorper and Merino ewes on veld at Glen. Neither supplementary energy nor CP when dosed in isolation, yielded any significant response in body mass changes during winter. However, a combination of energy and CP reduced body mass losses of the ewes by about 50%, simultaneously leading to small increases in the growth rate of their lambs. In contrast, these supplements had little effect on the body mass changes of Dorper ewes and their lambs during summer.

Herbage intake of lactating ewes increased considerably during summer (Table 3). Although supplementary energy and CP had little effect on herbage intake during winter, supplementary energy substituted for herbage intake during summer. In this respect, results concerning the DM disappearance rate in the rumen, as determined with the fibre-bag technique (De Waal, 1986), are particularly relevant (Table 3). Herbage, collected as previously mentioned and incubated in the rumen of the ewes, was found to have a DOM content of 57,8% and 59,5% and a CP content of 7,0% and 11,3% in winter and in summer, respectively (De Waal, 1986). CP supplementation tended to increase the rate at which herbage was fermented *in sacco* during the winter by 22% (26 *vs* 31,8% of DM disappeared/24 h), in comparison to 3,9% in summer (49,0 *vs* 50,9% of DM disappeared/24 h). Part of the slower rate of DM disappearance during winter (Table 3) could have been the result of sub-optimal ruminal ammonia concentrations, though it was evidently not the major restriction (De Waal, 1986). The relative resistance to microbial breakdown resulting from senescent herbage during winter seems to have been the factor that most limited the rate of fermentation.

Table 3 Effects of energy and crude protein (CP) supplementation on the rate of DM disappearance (*in sacco*) from the rumen and herbage intake (g DOM/$Wkg^{0,75}$/d) by lactating ewes during the winter and summer on veld at Glen (adapted from De Waal, 1986)

Daily supplements[a]	Winter		Summer	
	% DM disapp./24 h	g DOM/ $Wkg^{0,75}$/d	% DM disapp./24 h	g DOM/ $Wkg^{0,75}$/d
Control	24,9	41,9	52,5	60,3
100 g maize[b]	26,6 (26,0)[c]	37,3	50,3 (49,0)	46,3
200 g maize	26,5	39,5	44,3	51,6
60 g HPC 60[d]	31,2	39,5	54,5	62,7
60 g HPC 60 + 100 g maize	33,1 (32,8)	40,7	49,0 (50,9)	52,2
60 g HPC 60 + 200 g maize	34,1	41,7	49,0	50,6

[a] Provided via rumen fistulae.
[b] Coarsely ground maize meal.
[c] Figures in parentheses represent averages per energy/CP subtreatment.
[d] High Protein Concentrate 60.

Phosphorus is widely provided as a supplement for grazing ruminants in South Africa, despite evidence suggesting substantial differences between animal species in (i) the manifestation of the effects of a P deficiency on their performance and (ii) their response to P supplementation. Moreover, while some areas are clearly P deficient, other areas are evidently not. Read *et al.* (1986b) demonstrated the marked effects of supplementary P on reproducing beef cattle grazing veld at Armoedsvlakte, an area with a pronounced P deficiency. In a similar trial with reproducing beef cattle at Glen, where no clinical P deficiency was suspected, the marked response obtained at Armoedsvlakte could not be repeated (Read *et al.*, 1986b). Concurrent with the trial at Armoedsvlakte, reproducing Dorper ewes were run in close proximity to the cattle and P supplementation evinced no significant effects on the performance of the ewes and their lambs (Read, Engels & Smith, 1986a). However, implementation of a more sensitive and reliable indicator of the P status, *i.e.* bone P levels, identified a P deficiency in the unsupplemented ewes. Despite this, and contrary to common belief, the existence of a clinical P deficiency in grazing sheep in the Free State Region is doubtful. Reproducing Karakul ewes in the Gordonia district evinced no real response to P supplementation (Faure *et al.*, 1985). Likewise, reproducing Merino ewes and their lambs at Glen (Engels, Malan & De Waal, 1986 unpublished data) and reproducing Dorper ewes and their lambs at Koopmansfontein (De Waal, Engels, Malan, Terblanché & Baard, 1987 unpublished data) also failed to respond to P supplementation. In these studies, the bone biopsy technique (Little, 1972) proved to be a valuable tool in identifying P deficiencies at an early stage (Read, Engels & Smith, 1986c), even before clinical symptoms like depression in animal performance, notably reproduction, could be detected. Bone mineral concentrations should, however, always be interpreted in view of the nutritional history of the animals.

Performance of grazing ruminants

Body mass changes of grazing sheep and cattle generally follow seasonal trends in CP and DOM content of the veld during specific years, but differ between years. In the much-cited work of Swart, Van Schalkwyk, Hugo & Venter (1963), Merino wethers at Glen lost 24% of their summer body condition during the autumn and winter while the annual wool yield decreased by 22%. However, in other studies, Merino wethers have been known to maintain body condition during the winter (Engels & Malan, 1978) or even to increase in mass (Engels *et al.*, 1969), depending on the grazing conditions. Similarly, De Waal *et al.* (1981) found that young Merino and Dorper wethers maintained body condition (Table 1) during the winter, while grazing at the recommended stocking rate for Glen (6 ha/LSU per ann.). During lactation, excessive losses of body condition have been recorded during autumn/winter in Merino (Engels & Malan, 1979; De Waal, 1986), SA Mutton Merino (Engels & Malan, 1979) and Dorper ewes at Glen (De Waal, 1986) and at Koopmansfontein (De Waal, Engels, Malan, Terblanché & Baard, 1987, unpublished data). In contrast to this, De Waal (1986) showed that less mature, lactating Dorper ewes and their lambs performed considerably better when grazing veld during the active growing season (spring and summer), because of the improved quality and availability of acceptable herbage.

Clearly, animal production systems on veld should be planned according to the ability of the veld to satisfy the specific nutrient requirements for reproduction. Niemann & Heydenrych (1965) found that the weaning mass of calves decreased by 2,86 kg/week for calves born after 1 October, suggesting that the calving season

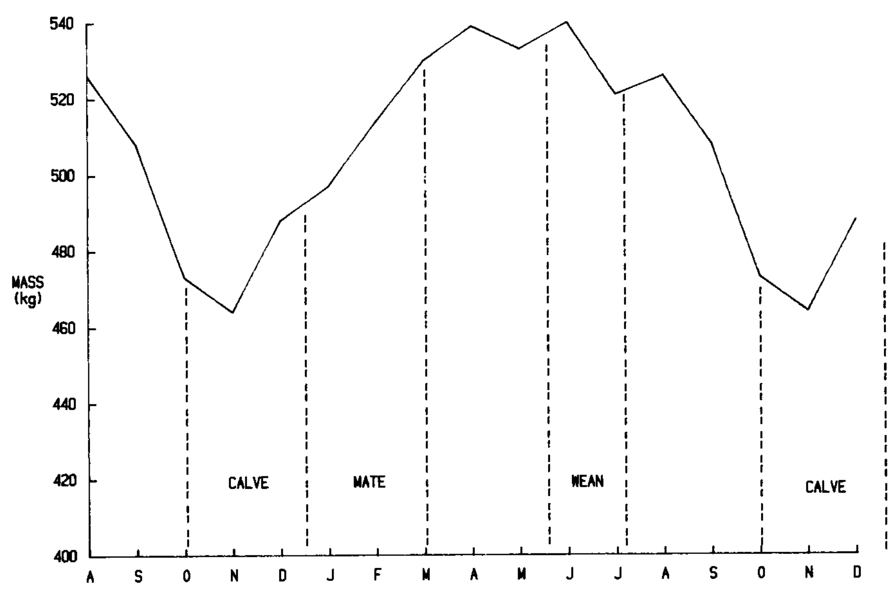

Figure 8 Average monthly body mass of mature reproducing beef cows on veld at Armoedsvlakte (Pottas & Basson, 1987 unpublished data).

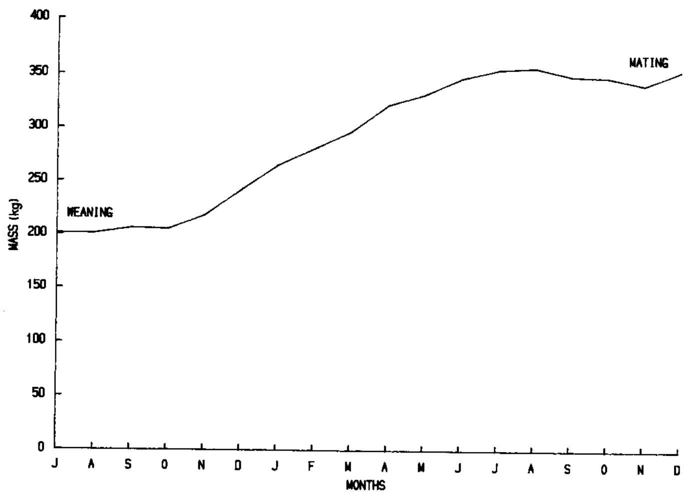

Figure 9 Average monthly post-weaning body mass of beef heifers on veld at Vaalharts (Pottas & Basson, 1987 unpublished data).

Table 4 Reproductive performance of beef cows and weaning mass of their calves at Armoedsvlakte and Vaalharts (Pottas & Basson, unpublished data)

Site	Period	Number of cows/year	Average calving %	Average weaning mass[a] (kg)
Vaalharts	1979—1983	564	91	222
Armoedsvlakte	1981—1986	65	94	225

[a] Weaning mass corrected to 210 days of age.

Table 5 Performance of Dorpers on veld at Glen during 1982—1986 (De Waal & Combrinck, unpublished data)

Sex, twin/single	Birth mass[a] (kg)	35-day mass (kg)	100-day mass (kg)	ADG[b] (g/d)
Single ram lambs	4,3	13,5	31,9	276
Single ewe lambs	4,2	12,9	29,2	250
Twin ram lambs	3,7	9,7	23,4	195
Twin ewe lambs	3,5	9,7	22,2	188

[a] Determined within 24 h after birth.
[b] Average daily gain, from birth to 100 days.

for beef cattle should commence as early as possible in spring. This is supported by the results obtained with beef cattle at Armoedsvlakte and Vaalharts (Figures 8 and 9; Table 4) and is also true for Dorper sheep at Glen (Table 5). In all these experiments, the stock were mated such that birth coincided with the emergence of the pasture's spring growth. At Armoedsvlakte and Vaalharts, the cattle had *ad libitum* access to a salt/P lick, while the Dorpers at Glen received a salt lick only. The sharp drop in body mass of mature, reproducing beef cows at the start of the calving season at Armoedsvlakte (Figure 8) may be accounted for by (i) the effect which the birth of a calf has on the *pre* and *post partum* body mass of its dam and (ii) the lower nutritive value of the veld at the end of winter. During the mating season, there was a sharp and continuous increase in the body mass of lactating cows, which reached a maximum at or about weaning. Thereafter, body mass decreased again due to the decline in quality and availability of the winter veld. The difference between the highest and lowest body mass of the cows during a full reproductive cycle (Figure 8), was about 60 kg and may be regarded as normal. Considering the good reproductive performance of the cows and the weaning mass of their calves, both at Vaalharts and Armoedsvlakte (Table 4), there appears to be little scope for improvement.

Changes in the post-weaning body mass of heifers at Vaalharts (Figure 9) are typical of what may be expected in the Northern Cape. During early summer, the heifers started to respond to the increase in nutritive value of the veld and reached a maximum body mass in autumn. During the following winter, the heifers maintained their body condition or, at worst, experienced a slight drop in body condition, whereafter pasture growth recommenced in early summer. A body mass of 354 kg at 26 months (about 70% of the mature mass) indicated that the heifers were in good condition and were ready to be mated.

Although changes in body mass of reproducing cows and ewes are, due to differences in gestation and lactation periods, not strictly comparable, the basic concepts are still applicable to both species. By applying sound pasture and animal management practices, the production levels attained by the herds on veld (Table 4 and 5) in the Free State Region, are within reach of most livestock producers.

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