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Dietary selection by steers grazing kikuyu

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Dietary selection trials were conducted on kikuyu pastures while being grazed for a period of 3,5 days in a four-week rotation, at stocking rates of 3,5 6,2 and 8,3 animals per hectare. The pasture was fertilized with 210 kg N/ha, split into three dressings over the season. The samples collected, namely fistula, available herbage, leaf and stem fractions, were analysed for crude protein, crude fibre and *in vitro* digestibility. Multiple regression analysis of the data showed that neither stocking rate, nor day of stay, nor season exerted a significant influence on the herbage selected by the grazing animal, relative to that on offer. The protein, fibre and digestible dry-matter contents of the selected material were significantly correlated with the levels in both the herbage and leaf fractions, but not with that in the stem fraction. Material with higher digestibility and fibre content than that of the herbage available, was selected. The protein levels in the fistula-selected samples were higher than the mean of the available herbage at low levels of herbage protein, whereas at high levels of herbage protein (CP > 15%), the protein levels of the selected samples were lower than the mean of the herbage available.

Dieet-seleksieproewe is op kikoejoeweiding uitgevoer terwyl dit vir 'n periode van 3,5 dae binne 'n vierweek-rotasiesiklus bewei is. Die veebelading was 3,5 6,2 en 8,3 diere per hektaar. Die weiding is bemes met 210 kg N/ha, versprei oor drie toedienings gedurende die seisoen. Die versamelde monsters, naamlik fistula, beskikbare weiding, blaar en stingel, is ontleed vir ruproteïen, ruvesel en *in vitro*-verteerbaarheid. Meervoudige regressie-ontleding van die data het getoon dat nie veebelading, of dag van beweiding, of seisoen 'n betekenisvolle invloed gehad het op die weidingmateriaal wat deur die diere geselekteer is nie. Die proteïen-, vesel- en verteerbare droëmateriaalinhoud van die geselekteerde materiaal was betekenisvol gekorreleerd met die ooreenstemmende waardes in beide die weiding- en blaarfraksies, maar nie met dié in die stingelfraksie nie. Die geselekteerde materiaal het 'n hoër verteerbaarheid- en hoër veselinhoud gehad as die beskikbare weiding. Die proteïenvlakke in die fistel-geselekteerde monster was hoër as dié in die beskikbare weiding by lae weidingproteïenvlakke. Hierteenoor was die proteïenvlakke van die geselekteerde monsters laer as dié in die beskikbare weiding by hoë weidingproteïenvlakke (RP > 15%).

Keywords: Kikuyu, herbage selection, crude protein, crude fibre.

Cattle improve the quality of their diet by actively seeking out particular plants, and avoiding others in the pasture. Even with preferred plants, cattle tend to eat only the most favourable parts available. A knowledge of diet selection allows management guidelines to be formulated to provide maximum animal production consistent with maintaining pastures in good condition (Rutherford, 1982). The material eaten, when compared with that on offer, usually has a higher content of nitrogen, phosphate and gross energy, but is lower in fibre content (Arnold, 1985). Animal selection studies on tropical pastures by Buchanan & Kerr (1988) revealed some surprising conclusions on the differences between people and cows in the evaluation of a perfect pasture. The perception of a perfect temperate pasture is short, dense and leafy. Their investigation on tropical pastures revealed that cows selected for leaf, but that taller pastures contained a higher leaf yield than short leafy pastures. They concluded that the cow was quite happy to select leaf from amongst the stem and seedheads.

Animal performance on kikuyu (*Pennisetum clandestinum* Hochst), relative to its chemical composition, is disappointing. This trial was, therefore, conducted to determine dietary selection by grazing cattle on kikuyu, the most common cultivated pasture species in Natal, to enable pasture management decisions to be based on animal preference data.

The experimental area of 3,1 ha kikuyu pasture, is situated on a NE slope on Cedara (29° 32′S; 30° 17′E) in the Natal Mistbelt. Cedara lies at an altitude of 1067 m and receives an average annual rainfall of 855 ± 142 mm, falling predominantly in the summer. The mean January maximum/minimum temperature is 25,1/14,9 °C, while frosts occur during the winter.

The kikuyu was fertilized with 210 kg N/ha, split into three dressings over the growing season, and with other elements according to soil analysis. Two duplicate blocks of pasture were grazed at three stocking rates (SR), equivalent to 3,5, 6,2 and 8,3 steers/ha for 3,5 days at regular intervals throughout the growing season, so as to simulate an eight-camp grazing system with a 28-day cycle. Oesophageal fistula samples were collected daily during the grazing period, and *ca.* 10 hand-cut herbage samples, cut to ground level, were simultaneously collected at random throughout the pasture. These herbage samples were subsequently bulked and divided into leaf and stem fractions. Crude protein (CP) (macro-Kjeldahl N) and crude fibre (CF) (Bredon & Juko, 1961) analyses were conducted on the composite plant, leaf and stem fractions of the plants as well as on the fistula samples. *In vitro* analyses (Minson & McLeod, 1972) were conducted on the composite and fistula samples to determine selection for quality.

Six steers, Sussex and Hereford, were fistulated at the oesophagus according to the technique described by Bredon & Short (1971). The animals were adapted to kikuyu grazing prior to the trial period and ran with the grazing animals on the various treatments to avoid poor sampling due to social interaction between strange animals during the trial period. Steers were randomly allocated to each SR at each grazing cycle. The fistulated steers were removed from the pasture during the morning and were deprived of feed, but not of water, for 4—6 h, and then used to collect fistula samples during the normal grazing cycle in the early afternoon.

Sufficient sample material was usually collected within half an hour of introducing the fistulated animals to the pasture. The daily sample was bulked for each treatment and the course sample was lightly rinsed to remove saliva prior to drying overnight, together with the handcut samples, at 90 °C in a forced draft oven. Dried samples were milled through a 1-mm screen for laboratory analysis.

Multiple regression (Genstat V) techniques were used to determine the relationships between dietary selection and both the plant fractions and their chemical constituents.

The trial was conducted over two summer grazing seasons. The chemical composition of the herbage fractions and diet selected is presented in Table 1. As the stem fraction provided no significant contribution to the regression estimating dietary selection in Season 1 (Table 2), these analyses were not continued in the second season.

Stocking rate, day on the pasture and season proved to be non-significant variables in a multiple regression analysis relating dietary selection to herbage on offer. This may seem surprising, but is consistent with Minson's (1981) statement that, when the quantity of leaf is low, animals grazing tropical species prefer to restrict intake rather than increase the quantity of stem in their diet. This would explain why the stem fraction made no significant contribution to the equation predicting dietary selection.

An unusual fact which emerged is that the animals selected for herbage and leaf material higher in CF than that of the cut samples, at least for CF levels below 30% (Table 3). This would suggest selection for older, more mature leaf material.

Table 1 Chemical composition of the kikuyu herbage, on a DM basis

Herbage fraction	Mean[1]	Range
	Season 1	
Crude protein		
Oesophageal	13,14 ± 2,25	9,31 — 20,13
Composite	11,87 ± 2,44	7,36 — 18,60
Leaf	12,80 ± 2,41	9,31 — 19,27
Stem	11,55 ± 2,23	8,40 — 19,98
Crude fibre		
Oesophageal	27,97 ± 2,26	20,90 — 32,54
Composite	25,91 ± 1,41	23,69 — 28,50
Leaf	25,05 ± 1,71	21,46 — 27,79
Stem	25,51 ± 1,69	21,76 — 28,10
	Season 2	
Crude protein		
Oesophageal	13,51 ± 2,24	8,84 — 18,60
Composite	12,09 ± 1,41	8,89 — 15,88
Leaf	12,92 ± 1,71	9,33 — 17,47
Crude fibre		
Oesophageal	28,04 ± 1,72	23,59 — 31,54
Composite	26,91 ± 1,61	23,38 — 30,56
Leaf	25,89 ± 1,99	24,11 — 31,56

[1] Mean: n = 33 in Season 1; n = 38 in Season 2.

Table 2 Regression equations describing the relationship between the chemical composition of the herbage and that selected by steers, where Y = fistula; X_1 = composite; X_2 = leaf, X_3 = stem

	R^2	*n*	*P*
Season 1			
Crude protein			
$Y = 8,43 + 0,363\ X_1$;	18,1	25	< 0,05
$Y = 7,19 + 0,478\ X_2$;	11,8	26	< 0,05
$Y = 8,92 + 0,369\ X_3$;	8,4	26	NS[1]
Crude fibre			
$Y = 13,03 + 0,589\ X_1$;	7,5	26	NS
$Y = 12,73 + 0,611\ X_2$;	18,5	28	< 0,05
$Y = 16,53 + 0,450\ X_3$;	8,7	28	NS
Season 2			
Crude protein			
$Y = 6,25 + 0,600\ X_1$;	17,6	37	< 0,01
$Y = 8,78 + 0,366\ X_2$;	12,2	37	< 0,05
$Y = 5,54 + 0,455\ X_1 + 0,191\ X_2$;	18,2	37	< 0,05
Crude fibre			
$Y = 15,78 + 0,456\ X_1$;	16,0	37	< 0,01
$Y = 25,30 + 0,105\ X_2$	1,4	37	NS
Pooled data			
Crude protein			
$Y = 7,65 + 0,461\ X_1$;	16,8	63	< 0,01
$Y = 8,22 + 0,404\ X_2$;	13,6	64	< 0,01
$Y = 5,99 + 0,361\ X_1 + 0,227\ X_2$;	20,2	63	< 0,01
Crude fibre			
$Y = 17,19 + 0,413\ X_1$;	10,0	63	< 0,01
$Y = 21,11 + 0,271\ X_2$;	5,7	66	< 0,05
$Y = 16,53 + 0,370\ X_1 + 0,070\ X_2$	8,9	63	< 0,05

[1] Not significant.

This is consistent with the findings of Jeffery (1971) and Soto *et al.* (1980) in that, within limits, the DMI of pen-fed sheep increased with increased maturity. Analysis of the dietary selection for CP indicates that there is an optimal protein level in the diet. When the average CP content of the material on offer is below this level, animals select a diet higher than the average of the herbage on offer, and vice versa. The optimum from these data appears to be *ca.* 14% CP on a DM basis. The selection for herbage with a higher fibre and lower CP level is consistent with the finding of Pattinson (1981), where the animals selected for higher levels of acid detergent fibre (ADF) and for lower CP levels on kikuyu. Pattinson (1981) found that ADF was positively correlated with *in vitro* DDM while CP was negatively correlated with DDM. *In vitro* determination on the composite herbage and fistula samples in this trial shows that the steers actively selected for herbage with higher DDM content.

DDM (fistula) = 21,8 + 0,724 (herbage DDM %); $r = 0,658$; $n = 28$; $P < 0,001$.

Table 3 Predicted difference between the composition of the herbage on offer and that selected by fistulated steers using the equations for the pooled data in Table 2 (*SE* of prediction: 1,2 for CP; 1,87 for CF)

Crude protein (%)		Crude fibre (%)	
Herbage	Selected	Herbage	Selected
10,0	12,3	22,0	26,3
12,0	13,2	24,0	27,1
14,0	14,1	26,0	27,9
16,0	15,0	28,0	28,7
18,0	15,9	30,0	29,6

The selection *for* high fibre and *against* high CP levels, and the associated selection for higher DDM content is consistent with work by Dugmore *et al.* (1986), in which positive correlations were found between both CF and ADF on *in vivo* DOM content of kikuyu herbage, whereas negative correlations were found between CP and DOM in kikuyu herbage.

The findings of this trial are a cause for concern with regard to present grazing management of our kikuyu pastures. Data collected by Dugmore *et al.* (1986) for kikuyu fertilized with nitrogen at levels below and above local recommendations and at an early and late regrowth stage, as well as data collected by Dugmore & du Toit (1988) for kikuyu at standard fertilizer recommendations, show that kikuyu pasture usually contains CP levels far in excess of the optimum selected for by steers. The results of this study suggest that, under local conditions, in order to supply herbage with the optimum CP and CF levels, kikuyu pasture should be fertilized with lower levels of nitrogen than commonly recommended, even though this would lead to reduced pasture yields. Alternatively, these pastures can be grazed at a later stage of regrowth than is normal, in order to maintain both high yields and to supply herbage with the optimum chemical composition for livestock. These conclusions appear to be confirmed by data from Tainton *et al.* (1982), who found that steer ADG declined as nitrogen fertilization increased and that the most econonic returns were achieved at the lowest levels of nitrogen fertilization for their study, as well as work by Henning & Le Roux (1987), who found that milk production was greater for cows grazing kikuyu on a 30-day cycle than on either a 20- or 60-day cycle.

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