Voluntary intake and quality of diet selected by cattle grazing bana grass, kikuyu and forage sorghum

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Bana grass (*Pennisetum purpureum* × *P. americanum*) was compared with kikuyu (*P. clandestinum*) and forage sorghum (*Sorghum bicolor*) with respect to quality of samples selected by four oesophageally fistulated steers. Hand-cut samples of the three forages were also compared with fistula samples for certain quality parameters. No significant difference ($P \geq 0,05$) was found between IVDOM and N content of hand-cut and fistula samples, but ADF and NDF values differed significantly ($P \leq 0,01$). Grazing significantly ($P \leq 0,05$) reduced the leaf : stem ratio of the pastures. Changes in this ratio were, however, not consistent among the different species over different periods. Kikuyu contained more N throughout the growing season than bana grass or sorghum ($P \leq 0,01$), while the IVDOM of sorghum was less ($P \leq 0,01$) than that of bana grass and kikuyu. Seasonal trends were significant on occasions. Kikuyu contained less cell wall (NDF) ($P \leq 0,05$) than bana grass and sorghum but the disappearance of NDF from nylon bags only differed significantly between kikuyu and sorghum. Organic matter intake (faeces voided measured by faecal bags) was consistently in the order of bana grass > sorghum > kikuyu, with a significant ($P \leq 0,05$) difference between bana grass and kikuyu. It was concluded that the general assumption in the literature that hybrid *Pennisetum* species based on Napier are soft and palatable, may be true for bana grass as well.

Banagras (*Pennisetum purpureum* × *P. americanum*) is met kikoejoe (*P. clandestinum*) en voersorghum (*Sorghum bicolor*) vergelyk ten opsigte van kwaliteit van monsters soos geselekteer deur vier slukdermgefistuleerde osse. Handsnymonsters van die drie weidings is terselfdertyd vergelyk met fistelmonsters vir sekere kwaliteitsparameters. Die IVVOM-waardes en N-inhoud van handsny- en fistelmonsters het nie betekenisvol ($P \geq 0,05$) verskil nie, maar SBV- en NBV-waardes het wel betekenisvol ($P \leq 0,01$) verskil. Blaar : stingelverhoudings van geselekteerde materiaal was betekenisvol ($P \leq 0,05$) laer ná wei as voor wei, maar die afname was nie eweredig tussen weidings oor seisoene nie. Kikoejoe het deurgaans 'n hoër N-inhoud as banagras en voersorghum gedurende die groeiseisoen gehad ($P \leq 0,01$), terwyl die IVVOM-waarde van voersorghum laer ($P \leq 0,01$) as dié van banagras en kikoejoe was. Seisoenale invloede was soms betekenisvol. Kikoejoe het minder selwande (NBV) ($P \leq 0,05$) as banagras of voersorghum bevat, maar die verdwyning van NBV uit kunsveselsakkies het slegs betekenisvol tussen kikoejoe en voersorghum verskil. Organiese materiaalinname (misuitskeiding deur middel van missakke gemeet) was deurgaans in die rangorde van banagras > voersorghum > kikoejoe, met 'n betekenisvolle ($P \leq 0,05$) verskil tussen banagras en kikoejoe. Die gevolgtrekking is gemaak dat die literatuuraanname dat *Pennisetum*-basters gebaseer op olifantsgras, sag en smaaklik is, waarskynlik ook geld vir banagras.

Keywords: Bana grass, digestibility, intake, kikuyu, leaf : stem ratio, oesophageal fistula samples, sorghum.

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Introduction

Tests done on bana grass (*Pennisetum purpureum* × *P. americanum*) in the fifties suggested that it was softer and more succulent than Napier grass (*Pennisetum purpureum*) (Anon., 1958). This was also reported for other hybrid *Pennisetum* species (Jodhpur, 1965) which, in addition, contained 25% more crude protein and more soluble carbohydrate than Napier. As with other grasses, forage quality will decline with age. In a study by Singh *et al.* (1965), crude protein decreased from 22% after two weeks of regrowth to 9% after 16 weeks and crude fibre content increased from 17 to 32%. However, frequent defoliation may maintain quality. Appadurai & Goonewardene (1973) for example, showed that crude protein content was maintained at 16% under a four weekly cutting regime.

Muldoon & Pearson (1979) found hybrid Pennisetum forage palatable and readily eaten by cattle and sheep. In a study by Bose *et al.* (1970), daily intakes varied in cattle from 1,5 to 2,5 kg DM per 100 kg live mass and in sheep, as reported by Singh *et al.* (1965), from 1,8 to 2,0 kg DM per 100 kg live mass.

The aims of this study were to examine the quality and intake of bana grass by oesophageally fistulated cattle over the growing season from spring to autumn. The data on bana grass were compared to similar observations on kikuyu (*P. clandestinum*), as another *Pennisetum*, and forage sorghum (*Sorghum bicolor*), which is normally grazed at about the same sward height as that recommended for bana.

Procedure

Details of bana and kikuyu establishments were described by Köster *et al.* (1992). Forage sorghum ('Sudex' cultivar) was sown at a rate of 15 kg/ha, which is lower than the 25—30 kg/ha normally recommended. Because of the lower seeding rate, 0,6 ha was allowed for grazing in comparison with 0,36 ha for kikuyu and 0,4 ha for bana grass. Forage sorghum was fertilized with 120 kg N/ha applied in four equal applications, treated with 2.4 D herbicide to control broad-leafed weeds, and irrigated weekly (15 mm).

Four oesophageally fistulated Drakensberger steers with a mean live mass of 607 kg grazed the three pastures. After each grazing period, bana grass and forage sorghum were cut to a height of 100—150 mm and kikuyu was cut to a height of 50 mm. Bana grass and forage sorghum were grazed at a regrowth height of 1 m and kikuyu was grazed at a regrowth height of 200 mm.

The growing season was divided into five grazing periods for data interpretation:

Period 1 – early spring (September—October).
Period 2 – late spring, early summer (November—December).
Period 3 – mid- to late summer (January—February).
Period 4 – early autumn (March).
Period 5 – mid-autumn (April—May).

Measurements on kikuyu and bana were taken during all periods, but on forage sorghum only during periods 2, 3 and 4. The growth rate of forage sorghum declined to such an extent during early autumn that regrowth during Period 5 was not sufficient to warrant grazing and measurement.

The steers were weighed after over-night fasting when introduced to a pasture and again after completion of the grazing period. The steers had access to pasture for 24 h per day. The adaptation period lasted 6—9 days and the faecal collection period, 4—5 days. The relatively short period on pasture was necessary to avoid excessive trampling and excreta contamination. In addition, a conventional adaptation period of 2—3 weeks was considered unnecessary because the quality of the grazed pastures corresponded closely (Tables 4—7). Faecal bags were fitted three days before collection started to accustom the animals to the extra burden, and were emptied regularly (three to four times daily) to avoid discomfort. After completion of a collection period on a particular pasture, animals were either introduced to the next pasture if regrowth was sufficient, or were allowed to graze a separate kikuyu pasture.

Oesophageal extrusa was collected for 20 min at the beginning and end of the faecal collection period to ensure a representative sample of the average quality thereof. Before collection, the steers were fasted for 6 h to avoid contamination by regurgitation. Extrusa samples were strained through a double layer of cheesecloth before being dried at 60 °C for 48 h and, together with hand-cut samples (Köster *et al.*, 1992), analysed in duplicate for DM, ash, NDF and ADF (Van Soest, 1966), N (kjeldahl) and *in vitro* digestibility of organic matter (IVDOM). IVDOM was determined according to the method of Tilley & Terry (1963) as modified by Engels & Van der Merwe (1967).

Faecal samples were oven-dried at 100 °C for 24 h to determine DM content and were combusted in an electric muffle furnace at 600 °C for 4 h to determine the ash content. Faecal OM was then calculated as the difference between faecal DM and faecal ash, and OM intake of the steers as OM excreted divided by the indigestible fraction as obtained from the IVDOM analysis.

Rate of NDF disappearance in the rumen was estimated by the nylon bag technique. Dried oesophageal collected samples of the three pastures were pooled over periods and tested collectively. Eleven Merino wethers, kept on lucerne hay, were used as test animals. Four sheep were randomly allocated to kikuyu and bana grass and three to forage sorghum. Seven bags per sheep were suspended in the rumen and removed after 0, 2, 4, 8, 12, 24 and 48 h respectively. These were subsequently thoroughly washed in cold water and dried to constant mass at 60 °C. The dried residue was then analysed for NDF and the disappearance of NDF was calculated as the difference between the initial and residual NDF quantities.

Leaf:stem ratios before and after grazing were determined in exclosure cages. Five exclosure cages of 1,2 × 1 m were placed at random on each paddock before grazing and representative samples of material harvested from the cages, were split into leaf and stem fractions. After grazing, randomly placed quadrats were used to assess the amount of remnant and the leaf:stem ratio thereof.

A two-way analysis of variance with the GLM model [Statistical analysis system (SAS), 1985] was employed to determine the significance of differences between pastures and periods in quality parameters of oesophageal extrusa, NDF disappearance and voluntary intake. Both 5% and 1% levels of significance in Bonferroni were accepted. Differences between hand-cut and oesophageal samples and leaf:stem ratios before and after grazing were determined by the paired *t* test with the level of significance at 5%.

Results and Discussion

Leaf:stem ratio

Leaf:stem ratios of bana grass, kikuyu and forage sorghum before and after grazing, are shown for different periods in Table 1. Overall, cattle selected positively for leaves with the leaf:stem ratio changing from 61:39 prior to grazing to 40:60 after grazing; the change being highly significant. Within pasture, the change was not significant for kikuyu and forage sorghum, while the change for bana grass approached significance at the 5% level of probability ($P < 0{,}056$). Bana grass had the highest pecentage leaf initially, followed by kikuyu and then sorghum. The biggest apparent change in leaf:stem ratio with grazing was realized with sorghum (49:51 to 16:84) followed by bana grass (68:32 to 48:52) and then kikuyu, which showed very litle change (65:35 to 56:44). Within grazing period, leaf:stem ratio decreased significantly during Period 3 only (Table 1), although the tendency was consistent for all periods.

Results of Köster *et al.* (1992) showed that bana leaves contained less cell wall than bana stems, which confirms what is usually found in most grasses (Laredo & Minson, 1975; Norton, 1982). Bana stem cell wall, however, was not less digestible than bana leaf cell wall. In fact, it could have been more digestible. Therefore, the selection for leaves must be ascribed to factors other than those associated with ruminal degradation of cell walls. It may, for example, be due to differences in chewing resistance associated with the higher cell wall content of stems.

Table 1 Leaf:stem ratios of bana grass, kikuyu and forage sorghum before and after grazing

Period[a]	Pasture	(%) Leaf : stem ratio (DM basis) Before grazing	After grazing	Pr > T
2	Bana	78 : 22	55 : 45	
	Kikuyu	63 : 37	67 : 33	
	Sorghum	35 : 65	11 : 89	
	Period	59 : 41	44 : 56	0,419
3	Bana	66 : 34	44 : 56	
	Kikuyu	62 : 38	39 : 61	
	Sorghum	64 : 36	20 : 80	
	Period	64 : 36	34 : 66	0,016*
4	Bana	74 : 26	44 : 56	
	Kikuyu	67 : 33	58 : 42	
	Sorghum	47 : 53	16 : 84	
	Period	63 : 37	39 : 61	0,132
5	Bana	54 : 46	47 : 53	
	Kikuyu	67 : 33	58 : 42	
	Period	61 : 39	53 : 47	0,237
Pasture average	Bana	68 : 32	48 : 52	0,056
	Kikuyu	65 : 35	56 : 44	0,176
	Sorghum	49 : 51	16 : 84	0,125
Overall average		61 : 39	40 : 60	0,003**

[a] Leaf : stem ratio was not measured in Period 1.
* Significant.
** Highly significant.

Hand-cut *vs.* oesophageal samples

In view of the above-mentioned results, it was surprising to find that oesophageal extrusa contained significantly more cell wall constituents than hand-cut samples (Table 2). This could be explained on the basis of soluble cell contents being lost during preparation of oesophageal samples, but then one would have expected significant differences between hand-cut and oesophageal samples in IVDOM and N as well.

Table 2 Chemical composition of pooled[a] hand-cut and oesophageal samples of bana grass, kikuyu and forage sorghum

Constituent	Samples Hand-cut	Oesophageal	Pr > T
% OM	79,0 ± 1,72	81,3 ± 2,57	0,016*
% IVDOM	65,9 ± 4,51	64,1 ± 2,84	0,284
% NDF (DM)	58,7 ± 3,31	66,8 ± 3,75	0,0001**
% ADF (DM)	32,3 ± 3,55	35,8 ± 4,15	0,0001**
% N (DM)	2,95 ± 0,83	3,10 ± 0,90	0,059

[a] Samples were pooled because there were not sufficient samples to warrant separate analyses on pastures or periods.
* Significant.
** Highly significant.

The ability of the grazing animal to select material of higher quality than the average presented to it, has been well documented (Hardison *et al.*, 1954; Engels & Malan, 1978). The fact that in this particular study no significant differences in IVDOM were found between hand-cut and oesophageal samples of bana grass, kikuyu and forage sorghum, probably suggests that selectivity is reduced when steers are presented with a relatively homogeneous sward of a young physiological age rather than a heterogenous one (Table 2).

Nitrogen selection

The N contents of oesophageal extrusa of bana grass and forage sorghum for five periods are shown in Table 3. The N content of kikuyu was significantly ($P \leq 0{,}01$) higher during all periods than that of both bana grass and forage sorghum, while the difference between bana grass and forage sorghum was not significant. Over periods, differences in N content were not significant.

Table 3 Nitrogen contents of oesophageal extrusa from bana grass, kikuyu and forage sorghum during different sampling periods

Period	% N (DM basis) Bana	Kikuyu	Sorghum	Period average
1	$2{,}69_{1}^{cd}$	$3{,}79_{2}^{a}$	–	3,24
2	$2{,}82_{2}^{d}$	$3{,}71_{3}^{a}$	$2{,}55_{1}^{b}$	3,03
3	$2{,}15_{1}^{ab}$	$4{,}28_{3}^{bc}$	$2{,}89_{2}^{c}$	3,11
4	$2{,}51_{2}^{bc}$	$4{,}35_{3}^{c}$	$2{,}23_{1}^{a}$	3,03
5	$2{,}10_{1}^{a}$	$3{,}98_{2}^{ab}$	–	3,04
Pasture average	$2{,}46_{1}$	$4{,}02_{2}$	$2{,}56_{1}$	

[a—d] Different superscripts in the same column differ significantly at the 5% or 1% level.
[1—3] Different subscripts in the same line differ significantly at the 5% or 1% level.
Standard error of the mean = 0,71%.

In this study, pastures were grazed after 3—4 weeks of regrowth. Ware (1978) found a 4-week rest period between grazing necessary to maintain quality in a kikuyu pasture and reported crude protein contents of some 23%, which compares favourably with the average of 25,1% in this trial. Dugmore & Du Toit (1988) and Marais *et al.* (1987) found the N content of kikuyu to peak in autumn. This corresponds with the finding in this study. Tainton (Tainton, N.M., 1978, unpublished results), as quoted by Cross (1979), reported similar seasonal trends in N values of kikuyu to those shown in Table 3.

The average crude protein content for forage sorghum of 15,6% compares well with the 17% observed by Sumner *et al.* (1965) at the same levels of N fertilization, and with the value of 12—17% reported by Krupa *et al.* (1974). Nitrogen fertilization levels for forage sorghum were much lower than those for bana grass and kikuyu, yet there was no significant difference between bana grass and forage sorghum in N content (Table 3), apart from seasonal trends.

Table 3 shows that the N content of bana grass was lower ($P \leq 0,05$) at two periods during the growing season (mid-- late summer and mid-autumn). The decrease in mid-autumn might have resulted from high growth rates (Norton, 1982) (see Köster *et al.*, 1992), while the decrease in summer might have been caused by high temperatures. Colman & Lazenby (1970) showed that the efficiency of N utilization in C_4 plants is higher at temperatures between 23—35°C than at temperatures between 13—24°C. Additionally, tissue N content is also decreased by high temperatures.

The average crude protein content of bana grass of 15,4% compares favourably with that of other hybrid *Pennisetum* species. Johnson *et al.* (1973) reported crude protein contents of *P. purpureum* of 20% at 4 weeks of regrowth; Flint *et al.* (1971) 17,3% at 3 weeks of regrowth and 14,5% at 6 weeks of regrowth, and Gutierrez & Faria (1978) 15,5—18,2% at 37 days of regrowth.

Cell wall constituents of selected material

Tables 4 and 5 show ADF and NDF values of oesophageal samples of bana grass, kikuyu and sorghum for five periods.

Table 4 ADF contents of oesophageal extrusa from bana grass, kikuyu and forage sorghum in each of five periods

	% ADF (DM basis)			Period
Period	Bana	Kikuyu	Sorghum	average
1	$28,7^{a}_{2}$	$24,4^{a}_{1}$	–	$26,6^{a}$
2	$36,9^{b}_{2}$	$32,7^{b}_{1}$	$38,2^{b}_{2}$	$36,0^{b}$
3	$40,2^{c}_{3}$	$30,4^{b}_{1}$	$35,2^{a}_{2}$	$35,3^{b}$
4	$40,8^{c}_{2}$	$30,8^{b}_{1}$	$40,3^{b}_{2}$	$37,3^{b}$
5	$38,6^{bc}_{2}$	$31,8^{b}_{1}$	–	$35,2^{b}$
Pasture average	$37,1_{2}$	$30,0_{1}$	$37,9_{2}$	

a—c Different superscripts in the same column differ significantly at the 5% or 1% level.

1—3 Different subscripts in the same line differ significantly at the 5% or 1% level.

Standard error of the mean = 0,58%.

Table 5 NDF contents of oesophageal extrusa from bana grass, kikuyu and forage sorghum in each of five periods

	% NDF (DM basis)			Period
Period	Bana	Kikuyu	Sorghum	average
1	$61,1^{a}$	$60,4^{a}$	–	$60,8^{a}$
2	$67,4^{b}_{2}$	$64,6^{b}_{1}$	$71,2^{b}_{3}$	$67,7^{b}$
3	$72,1^{d}_{3}$	$59,3^{a}_{1}$	$65,6^{a}_{2}$	$65,7^{b}$
4	$70,8^{cd}_{2}$	$65,8^{b}_{1}$	$69,3^{b}_{1}$	$68,6^{b}$
5	$68,9^{bc}_{2}$	$63,9^{b}_{1}$	–	$66,4^{b}$
Pasture average	$68,1_{2}$	$62,8_{1}$	$68,7_{2}$	

a—d Different superscripts in the same column differ significantly at the 5% or 1% level.

1—3 Different subscripts in the same line differ significantly at the 5% or 1% level.

Standard error of the mean = 0,66%.

Kikuyu had significantly ($P \leq 0,01$) less ADF and NDF than bana grass and forage sorghum, while the differences between the latter two were not significant. For both, cell wall constituents increased significantly from Period 1 to Period 2, but then stayed essentially unchanged for the remainder of the growing season.

The average ADF content of kikuyu of 30,0% (Table 4) compares favourably with the 29,1% reported by Pattinson *et al.* (1981). Little information is available on cell wall constituents of forage sorghum, but the significantly ($P \leq 0,05$) higher cell wall contents during Periods 2 & 4 could have been due to the steers having to take in an increasing amount of stem material towards the end of the grazing period, as a result of reduced availability of leaf material. Cell wall constituents of forage sorghum did not differ significantly from those of bana grass in general, but they did differ significantly between different periods (Tables 4 & 5). On average, an NDF of 68,1% and ADF of 37,1% for bana grass are in reasonable agreement with the 63 and 43% respectively reported for *P. purpureum* by Yeo (1980) after 40 days of regrowth.

Waite (1970), in agreement with Ford & Williams (1973), observed a small decrease in cell wall content with increasing N fertilization. This may partly explain the differences between pastures. However, as N was applied in equal dressings throughout the growth season, period differences due to N were unlikely. High growth rates though, could have had an effect. Higher values for cell wall constituents during Periods 3 & 4 in the case of bana grass coincided with the periods of highest DM yield (see Köster *et al.*, 1992). Under these conditions, one would expect the plant to be physiologically somewhat older than the same plant growing more slowly, but measured after the same period of regrowth.

Cell wall fermentation and digestibility of OM

Disappearance of NDF from nylon bags of bana grass, kikuyu and forage sorghum is shown in Table 6.

The average percentage disappearance and the rate of disappearance per hour were significantly ($P \leq 0,01$) lower for forage sorghum than for bana grass and kikuyu. Bana grass and kikuyu did not differ significantly despite the higher NDF

Table 6 Disappearance of NDF of bana grass, kikuyu and forage sorghum from nylon bags suspended in the rumen of sheep

	% Disappearance of NDF		
Time (h)	Bana	Kikuyu	Sorghum
2	15,7	9,6	13,8
4	19,9	18,0	16,4
8	33,4	27,6	26,9
12	$45,7_{2}$	$44,8_{2}$	$33,4_{1}$
24	$55,7_{2}$	$61,8_{2}$	$41,4_{1}$
48	$68,9_{1,2}$	$73,9_{2}$	$60,1_{1}$
Pasture average	$39,9_{2}$ ± 6,91	$39,3_{2}$ ± 6,91	$31,0_{1}$ ± 7,98
Rate (% / h)	$3,04_{2}$	$2,97_{2}$	$2,36_{1}$

1,2 Different subscripts in the same line differ significantly at the 5% or 1% level.

content of bana grass. Meissner *et al.* (1991b) showed, with a number of forages, that the rate of NDF disappearance is very much a function of amount of NDF, i.e. the more NDF present, the less disappears per unit time. According to their prediction equation, there should have been no difference in the rate of NDF disappearance in bana grass and forage sorghum, since they contained the same amount of NDF (Table 5). This observation coincided with the observation that the IVDOM of bana grass was significantly higher than that of forage sorghum but very similar to that of kikuyu (Table 7); despite the fact that the amount of cell wall constituents of bana grass was similar to that of forage sorghum, but significantly more than kikuyu (Tables 4 & 5). In comparison to forages of similar quality, and assuming other factors to be equal, these findings suggest that intake on bana grass may be higher because of shorter rumen retention times (Allinson & Osbourn, 1970; Laredo & Minson, 1975).

Table 7 IVDOM of bana grass, kikuyu and forage sorghum in each of five periods

Period	% IVDOM			Period average
	Bana	Kikuyu	Sorghum	
1	$64{,}3^{ab}$	$62{,}5^{a}$	–	$63{,}4^{a}$
2	$62{,}5^{a}$	$62{,}4^{a}$	61,3	$62{,}1^{a}$
3	$65{,}0_{1,2}$	$65{,}7_{2}^{b}$	$63{,}1_{1}$	$64{,}6^{b}$
4	$64{,}7_{2}^{ab}$	$66{,}2_{2}^{b}$	$61{,}3_{1}$	$64{,}1^{b}$
5	$66{,}7^{b}$	$67{,}1^{b}$	–	$66{,}9^{b}$
Pasture average	$64{,}6_{2}$	$64{,}8_{2}$	$61{,}9_{1}$	

^{a,b} Different superscripts in the same column differ significantly at the 5% or 1% level.

$_{1,2}$ Different subscripts in the same line differ significantly at the 5% or 1% level.

Standard error of the mean = 0,65%.

With period, IVDOM increased significantly (Table 7). This trend has been reported before for kikuyu (Pattinson, 1981; Dugmore & Du Toit, 1988). There was also a significant period × pasture interaction. The IVDOM of kikuyu of 64,8% compares favourably with the 66,6% observed by Pattinson *et al.* (1981), while IVDOM of bana grass of 64,6% closely corresponds with the figure of 66,6% reported by Goonewardene & Appadurai (1972) for a hybrid *Pennisetum*. No comparative data could be found in the literature for forage sorghum.

Voluntary intake

Organic matter intake of steers on bana grass, kikuyu and forage sorghum is shown in Table 8. Within period, OM intake of bana grass was significantly ($P \leq 0{,}01$) higher than OM intake of kikuyu during Period 5 only, but intake consistently tended to be higher for bana grass in all periods. Overall, OM intake of bana grass was significantly higher than that of kikuyu, with forage sorghum intermediate. The difference between bana grass and forage sorghum was accentuated when digestible OM intake was compared. There was no overall significant seasonal trend in intake within pastures.

Table 8 OM intake of steers on bana grass, kikuyu and forage sorghum during different periods

Period	OM intake (kg/d)			Period average
	Bana	Kikuyu	Sorghum	
1	7,91	7,66	–	7,79
2	7,87	6,57	7,35	7,26
3	8,16	7,07	7,45	7,56
4	8,21	7,14	8,61	7,99
5	$9{,}72_{2}$	$6{,}57_{1}$	–	8,15
Pasture average	$8{,}37_{2}$	$7{,}00_{1}$	$7{,}80_{2}$	
Digest. (D) OM intake	$5{,}41_{2}$	$4{,}54_{1}$	$4{,}83_{1,2}$	

$_{1,2}$ Different superscripts in the same line differ significantly at the 5% or 1% level.

Standard error of the mean: OM intake = 0,47 kg; DOM intake = 0,40 kg.

If the OM intake of bana grass, kikuyu and forage sorghum is converted to DM intake, the average values shown in Table 8 for each species increase to 10,3; 8,64 and 9,63 kg/d, respectively. These values correspond to 1,67; 1,44 and 1,62 kg/100 kg live mass respectively. These values are at the lower end of the scale of DM intake of between 1,5 to 2,5 kg DM/100 kg live mass reported by Bose *et al.* (1970) for cattle on hybrid *Pennisetum* forage. One would, therefore, clearly have expected higher intakes even though the steers in the study were mature animals.

The steers apparently did have unrestricted access to the pasture material, since the yield study (Köster *et al.*, 1992) revealed no shortage in grazable material. Also, the steers apparently adapted well to the management routine on pasture as OM intakes on average did not differ significantly from Period 1 through to Period 5 (Table 8). However, it is possible that the almost continuous collection of faecal and oesophageal material might have been stressful and depressed intake.

Another explanation for the low intake is high moisture content of the pasture forage. Many authors have found high moisture contents, especially above 65%, to limit intake considerably (Gordon *et al.*, 1961; Roffler *et al.*, 1967; Burgess *et al.*, 1981; Meissner *et al.*, 1991a). The moisture contents did not differ much between the three pastures, but averaged a high 86% over the growing season.

Since little difference in moisture content had been observed between pastures, it was not considered as a possible reason for the differences in intake between pastures. One would expect that the lower intake of forage sorghum in comparison with bana grass, is related to its lower digestibility overall (Table 7) and the slower rate of cell wall (NDF) digestibility (Table 6) in particular. Voluntary intake of a forage has been shown to be positively related to rate of digestion of cell wall constituents (Allinson & Osbourn, 1970), as a slow rate of digestion would increase rumen retention time (Laredo & Minson, 1975) and decrease intake (Meissner *et al.*, 1991b).

Rate of cell wall digestibility, however, did not differ significantly between bana grass and kikuyu (Table 6), and kikuyu had significantly less cell wall than bana grass (Table 5). This suggests that the lower intake of kikuyu might be related to other factors. Pienaar *et al.* (1989) postulated oxalic acid and possibly saponins in kikuyu as contributing factors. Dugmore & Du Toit (1988) found a significant negative correlation between DM intake and the NPN content of kikuyu. The high NPN content contributes to the imbalance between N and soluble carbohydrate in the rumen, which was found by Pienaar and colleagues (Pienaar, J.P., 1991, personal communication to H.H. Meissner) to raise rumen ammonia to unacceptable levels and depress intake of kikuyu.

Conclusions

The quality of bana grass compared favourably with that of kikuyu and forage sorghum while intake thereof was consistently better. Of particular significance was the higher than expected cell wall digestibility, including that of stem material (Köster *et al.*, 1992), which partially explains the general agreement in the literature that the hybrid *Pennisetum* is softer and more palatable than other *Pennisetum* species such as Napier grass.

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