THE NUTRITIVE VALUE OF HAY FROM FOUR GRASS SPECIES CUT AT THREE STAGES OF GROWTH AT IBADAN

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SUMMARY

Four grass species namely: *Cynodon nlemfuensis* var *robustus* (M); *Pennisetum purpureum* Schum (N); *Cynodon nlemfuensis* var *nlemfuensis* (P); and *Panicum maximum* Jacq. (Q), each between the 4th and 5th, 6th and 7th, and 8th and 9th week of regrowth, was cut in the fourth and fifth years of grazing for hay (i.e. in 1972 and 1973). Digestion trials with West African dwarf sheep showed that there were significant differences in the extent to which the dry matter of the different grass species was digested (P 0.001) and among the stages of growth (P 0.01). The differences between animals within and between treatments and the interactions between treatments and periods of cutting were statistically not significant. The differences among treatment means indicated that treatment Q (68.5 $\pm$ 2.73%) was digested better than treatment M (54.9 $\pm$ 7.18%, P 0.001), and treatments N and P (60.3 $\pm$ 5.37% and 58.7 $\pm$ 5.30% P 0.01) respectively.

The digestibility of crude protein was generally low in each of the grass species studied. This is probably a reflection of the low crude protein content of the grass

hays which was below 9 percent of dry matter. It ranged from approximately 27.3 percent in treatment N for the 6th week regrowth hay to 51.9 percent in treatment Q for the hay harvested in the 8th week of regrowth. The differences among treatments, stage of maturity, and the interactions between treatments and stage of cutting were not statistically significant.

Significant differences between treatments were observed in the digestion of the energy content of the feeds (P 0.001). Treatments N and Q were better digested than M and P (P 0.05).

Expressed on metabolic size basis, the intakes of dry matter, crude protein, and energy showed significant differences between treatments and between ages at harvest. The intakes of dry matter in treatments Q, M, and P were significantly higher (P 0.05) than treatment N while there was more dry matter taken from the 4th and 8th week hays than from the hays made from the species harvested in the 6th week of regrowth (P 0.01). More crude protein was consumed per $kg^{0.75}$ in treatments M, P and Q than in treatment N (P 0.01), and in treatment M than Q (P 0.05). There were higher protein intakes from hays made in the 4th and 8th than those made in 6th week of regrowth (P 0.05). Treatment Q supplied more energy per $kg^{0.75}$ than treatments M, P and N (P 0.05), while more energy was consumed per kilogramme of metabolic size in treatment P than in treatment N (P 0.05).

The intake of digestible crude protein was relatively low and this probably accounted for the losses in the liveweight of the experimental animals.

The results of the experiment are suggestive of the need for supplementary protein feed during the dry season if animals are to make any liveweight gains.

INTRODUCTION

Dry season feeding of livestock especially of domesticated ruminant animals, has always posed constant problems to the livestock farmers since there is little or no pasture to graze during the long dry season of the tropics. As a result, animals particularly cattle, tend to lose more weight than they gained in the previous period of lush.

Attempts have been made in the past to provide for the dry season by conserving forage either in the form of hay or silage. The latter form of conserved forage is more suited to the Southern part of Nigeria because the wet conditions usually prevailing at the peak production of green forage, are unsuitable for hay production. However, there are some years in which the weather situations towards the end of the rainy season are conducive to hay making in the South.

A number of studies has been made to investigate the nutritive value of standing hay with or without supplementation as well as hay made from both grass and legume species in this country and elsewhere in the tropics (Miller, Rains and Thorpe, 1964; Haggar, 1970; Brinckman, 1974; Lansbury, 1958; Elliot and Croft, 1958; Elliot and Fokkema, 1960; Smith, 1962). The main object of the present studies is to assess the nutritive value of hays made from four different grazed pasture grass species cut at different stages of growth.

MATERIALS AND METHODS

The four grass species used in making the hays studied in this experiment namely: Cynodon nlemfuensis var robustus (M); Pennisetum purpureum Schum (N); Cynodon nlemfuensis var nlemfuensis (P); and Panicum maximum Jacq (Q), were planted as pure stands between August and September, 1968 at the University of Ibadan Teaching and Research Farm.

The experimental area consisted of 3. 64 ha which was divided into four equal plots of approximately 0. 91 ha each. Each plot was further divided into four equal strips of approximately 0. 23 ha each and each strip was sub-divided into six sub-plots of about 0. 04 ha each. The resulting 96 subplots were randomized and planted to the four grass species such that the grasses could be grazed or harvested at three stages of growth, namely: at 4, 6 and 8 weeks of regrowth.

At about the middle of April, 1969, the grasses were cut back so as to allow for uniform regrowth. At 4, 6 and 8 weeks of regrowth the pastures were rotationally grazed by White Fulani (Zebu) steers. Each treatment subplot was cut back to allow for uniform regrowth after grazing.

Nutritive Value of Hay.

Application of Fertilizers*

No fertilizer was applied to the pastures in 1969 because of non-availability in the country. In 1970, 251 kg/ha of triple superphosphate was applied in two equal instalments on May 13 and on August 18, respectively. In 1971, 251 kg/ha of urea was applied on May 28 and on August 17, respectively. In 1972, 251 kg/ha and approximately 126 kg/ha of single superphosphate were applied in two instalments as in the two preceding years. On August 23, 1973 half of the fertilizers used in 1972 was applied.

The grasses cut for hay in 1972 were harvested in November, while those for 1973 were harvested on September 18, for the 6th and 8th week regrowths and on October 23, for the 4th week regrowth. The cut grasses were field-cured for forty-eight to seventy-two hours, gathered and made separately into 30 to 40 kg bales and stored in the shed until they were used for the digestion trials.

Digestion Trials.

The first experiment consisting of three digestion trials was carried out with twelve West African dwarf rams ranging in liveweights from 26 kg to 35 kg with a mean of 29 $\pm$ 3.20kg between December 1972 and February 1973. Each trial consisted of ten days preliminary period followed by six days of collection period. The four grass species were regarded as four treatments and each treatment was tested at the three stages of growth. The rams were randomized into four groups of three animals each and each group was assigned to each treatment. Each digestion trial was conducted with hays cut at the same stage of growth for the four treatments. The second experiment was similar to the first and was conducted between March and May 1974. The first trial which had a collection period of twenty-one days was preceded by a nine-day preliminary period. Each of the remaining two trials was preceded by a nine-day preliminary period followed by seven-day collection periods. The second experiment differed from the first in that two rams were used per treatment, the liveweights of which ranged from approximately 24 to 32 kg with a mean liveweight of 28.0 ± 3.08 kg in trial one, 23 to 33 kg (mean 28 ± 3.38kg), and 24 to 32 kg (mean 28 ± 3.42kg) in trials two and three respectively. Each ram was harnessed with a collection bag attached for the total collection of faeces. During each preliminary period, 1.0 kg of hay at the appropriate stage of regrowth was offered to each ram twice daily (approximately 500 g each at 08.00 hours and at 16.00 hours). During each collection period, each animal was offered the mean of its daily dry matter intake during the preliminary period less ten percent. Before the first day's portions of the feeds were offered about 500 g representative samples were taken from each treatment lot for dry matter determination and chemical analyses. Similar samples were taken subsequently every three days. Faeces were collected at 08.00 hr. and at

16.00 hr. just before feeding. The morning and evening faecal collections for each ram were bulked, weighed, thoroughly mixed and representative samples taken for dry matter determination and for chemical analysis. Each day's orts for each ram were similarly treated. Tap water and salt licks were provided ad lib.

Samples meant for dry matter determinations were dried in the electric oven at 105°C to constant weight (48 hours) and those meant for proximate analysis were dried in a forced-drought oven at 70°C for three days, and later milled in a Christy-Norris hammer mill to pass through 1.66 mm mesh, labelled and stored in air-tight Kilner hars or machine sealed plastic bags until needed for analysis.

Chemical Analysis.

Proximate analyses were as described by Olubajo and Oyenuga (1970) except that the crude fibre was determined by the trichloroacetic acid method (Anon, 1967). The energy contents of the feed and faecal samples were determined with a Gallenkamp ballistic calorimeter.

Statistical Analysis.

Analyses of Variance were those based on factorial design in which animals in each treatment were regarded as replicates, the four treatments as the main treatments and stages of maturity as sub-treatment observations.

RESULTS

The proximate composition of the grass hays are shown in Table 1. The data in Table 1 indicate that the crude protein content of the grass hays are low

Table 1. Chemical Composition of Grass Hay

Treatment	Age (weeks)	Dry matter at harvest (%)	Residual dry matter (%)	Silica-free ash	Crude protein	Crude fibre	Ether extracts	N-free extracts
				% of dry matter.				
C. nlemfuensis var robustus	4	31.60	92.04	3.86	7.91	34.47	1.21	52.55
	6	26.00	91.13	4.38	8.61	37.96	1.14	47.91
	8	26.00	92.12	5.67	8.26	38.57	1.35	46.15
Pennisetum purpureum	4	15.41	92.87	5.76	7.93	38.79	0.87	46.65
	6	17.20	91.91	6.02	7.49	36.72	1.26	48.51
	8	22.50	92.12	8.20	6.40	37.50	1.20	46.70
C. nlemfuensis var nlemfuensis	4	29.89	93.20	5.24	7.27	40.54	1.01	45.94
	6	23.70	91.09	4.78	8.34	37.47	1.06	48.35
	8	23.50	91.50	3.92	8.34	42.21	1.13	44.40
Panicum maximum	4	23.00	92.74	5.67	6.72	42.60	0.92	44.09
	6	22.00	91.86	3.31	4.77	44.89	0.79	46.24
	8	25.50	90.43	5.21	6.68	39.34	1.12	52.35

and the crude fibre high even for the hays made from grasses cut and conserved in the fourth week of regrowth. The apparent dry matter digestibility values shown in Table 2 are for hays made in 1972 and 1973 while the digestibility values of nutrients are for hays made in 1973. The dry matter digestibility values show that the hays made in 1973 have higher values than the values obtained in the previous year. This is probably as a result of the period of the year in which the latter were cut for hay, a period which was drier than the periods of cutting in 1973. In addition, more flowering and therefore even poorer quality might be expected with harvests taken later in the year. The values ranged from approximately 37.8 percent for Pennisetum purpureum harvested in the 8th week of regrowth in 1972 to approximately 71.0 percent for Panicum maximum hay made at the same stage of regrowth the following year. The results showed that there were significant differences between treatments (P 0.001) and between the stages of regrowth at harvest (P 0.01). Treatments means showed that treatment Q was digested to a greater extent than treatment M (P 0.001) and than either of the other two treatments (P 0.01). Hays harvested in the 8th week of regrowth were more significantly digested than those made from grasses cut in the 4th and 6th week of regrowths, (P 0.01). With the exception of treatment M in which the dry matter of hay was slightly better digested in Experiment I than in Experiment II, treatments N, P and Q resulted in higher dry matter digestibility in Experiment II than in Experiment I (P 0.001).

The apparent digestibility of the crude protein content of the hays was low and is probably a reflection of the low crude protein and high crude fibre contents

Nutritive Value of Hay.

of the hays. It varied between approximately 27.3 percent for hay made from Pennisetum purpureum cut in the 6th week of regrowth to 51.9 percent in Panicum maximum hay made in the 8th week of regrowth. The degree of crude protein digestion either among treatments or among stages of growth at harvest was not significant (P 0.05). The crude fibre was more digestible in all the hays than either the dry matter, crude protein or the energy content. The mean apparent digestibilities were between 65.4 ± 8.33 percent for the local giant star grass hay (C. nlemfuensis var. robustus) and 79.0 ± 4.53 percent for Panicum maximum. The mean digestibility of the energy content of the grass hays parallels the dry matter digestibility in each of the treatments in the 1973 cuts. Differences between treatments were statistically significant (P 0.001). So also was the interaction between treatments and the stage of growth at cutting (P 0.05). Data indicate that the energy content of hays from the tall growing grass species (treatments N and Q) was digested to a greater degree than those of the hays from the stoloniferous species (P 0.001) while between the two varieties of star grass, C. nlemfuensis var nlemfuensis had higher energy digestibility (P 0.05). The soluble carbohydrate content was digested the most. There were no significant differences within each treatment, but among treatment differences were significant (P 0.05). Significant differences (P 0.05) existed between the N.F.E. digestibility of treatments N and Q on the one hand and of treatment N on the other.

Table 3. Dry Matter and Nutrient Intake of Sheep Fed Grass Hay[1]

Treat-ment	Age wks.	DMI	DDMI	CPI	DCPI	EI	DEI	Intake / kg$^{W0.75}$ DMI	DDMI	CPI	DCPI	EI	DEI	kg$^{W0.75}$
		(grammes per day)				(kcal/day)		(grammes per day)				(kcal/day)		
M	4	574.5	274.0	45.45	14.33	2482	1069	46.34	22.01	3.67	1.16	200	86	12.4
	6	539.0	296.0	46.41	18.25	2609	1489	43.11	23.65	3.71	1.44	209	119	12.5
	8	648.5	400.5	50.57	25.02	2756	1442	51.89	32.21	4.29	2.01	221	115	12.5
Mean		587.3±56.12	323.8±67.58	46.38±1.11	19.17±5.45	2616±142	1333±231	47.11^{a}±4.44	25.96^{b}±5.47	3.89^{a}±0.35	1.54^{a}±0.42	210^{b}±10.54	107^{b}±16.46	12.5±0.09
N	4	578.5	353.0	45.38	18.01	2829	1857	44.12	26.93	3.50	1.37	216	140	13.1
	6	423.5	235.5	31.72	8.36	1837	1217	32.36	18.09	2.42	0.69	145	93	13.1
	8	473.0	305.5	30.48	9.64	1995	1266	36.86	23.57	2.36	0.75	154	98	13.0
Mean		491.3±79.09	298.0±59.11	36.00±8.58	12.20±5.03	2240±462	1440±342	37.71^{b}±5.97	22.83^{b}±1.52	2.76^{b}±.63	0.94^{b}±0.37	172±37.54^{c}	110^{b}±26.87	13.0±0.01
P.	4	556.5	329.0	41.38	13.39	2960	2004	48.36	28.58	3.62	1.17	258	177	11.5
	6	447.5	239.5	37.32	12.87	1975	981	38.73	20.74	3.23	1.11	171	83	11.6
	8	553.5	352.0	46.18	23.56	2419	1311	48.53	30.87	4.05	2.07	212	115	11.4
Mean		519.8±61.98	305.5±59.24	41.29±4.48	16.61±6.02	2452±474	1435±548	45.22^{a}±5.60	26.73^{b}±5.31	3.60^{ac}±.42	1.45^{a}±0.54	214^{b}±42.28	125^{b}±47.73	11.5±0.1
Q	4	574.0	383.5	38.57	15.41	3160	2234	51.23	34.50	3.44	1.40	276	197	11.3
	6	495.5	331.5	33.20	14.25	2255	1521	43.25	29.13	2.91	1.20	196	133	11.5
	8	607.0	431.5	40.58	21.06	3186	2316	54.60	38.80	3.33	1.90	285	207	11.2
Mean		558.8±57.33	383.5±49.63	37.45±3.79	16.91±3.62	2847±465	2017±433	49.69^{a}±5.85	34.14^{a}±4.86	3.33^{c}±.27	1.51^{a}±0.35	252^{a}±50.27	179^{a}±40.15	11.4±0.77

1 Based on 1973 Experiment.

Nutritive Value of Hay.

The intake per head per day of dry matter (DMI), crude protein (CPI) and energy (EI) as well as of digestible dry matter (DDMI), digestible crude protein (DCPI), and digestible energy (DEI), are presented in Table 3. The mean DMI per head per day was highest for treatment M and lowest for treatment N. It varied between approximately 490 ± 0.08 g for Pennisetum purpureum hay and 590 ± 0.06 g for hay made with the robustus variety of Cynodon. The DDMI was slightly altered from the pattern shown for DMI. The highest mean intake value of about 380 ± 0.05 g was by sheep fed Panicum maximum hay. The CPI in all the treatments showed approximately the same trends as for DMI while the EI and the DEI exhibit a similar pattern as the DDMI except for DEI in treatment M. In order to obviate the differences that might have arisen in intake as a result of differences in the liveweight of the experimental animals, the intake of nutrients is also expressed on metabolic size ($kg^{W.075}$) basis (Table 3). The values shown in Table 3 indicate that on metabolic size basis the DMI, DDMI and DEI showed similar trend as obtained for DDMI on liveweight basis while the CPI and DCPI maintained the previous pattern. There were highly significant differences (P 0.001) among treatments and among stages of growth in DMI, EI and DEI expressed on metabolic size basis. Significant differences also existed between treatments in the intakes of crude protein and digestible crude protein (P 0.01).

Table 4. Total Digestible Nutrients (TDN) and Digestible Energy (DE) and Metabolizable Energy (ME) Intake of Grass Hays by Sheep

Treatments	Age (weeks)	TDN (%)	TDN (kg/100 kg liveweight)	DE (Mcal per kg DM)	ME (Mcal per kg DM)
C. nlemfuensis	4	47.64	0.95	1.87	1.53
var robustus	6	53.43	0.99	2.76	2.26
	8	52.19	1.16	2.22	1.82
Mean		51.09 ± 3.00	1.03 ± 0.10	2.28 ± 0.46	1.87 ± 0.37
Pennisetum	4	57.62	1.08	3.17	2.60
purpureum	6	52.62	0.72	2.87	2.35
	8	58.63	0.91	2.67	2.19
Mean		56.29 ± 3.22	0.90 ±0.19	2.90 ± 0.27	2.38 ± 0.85
C. nlemfuensis	4	56.13	1.20	3.66	3.30
var. nlemfuensis	6	51.43	0.88	2.15	1.76
	8	62.03	1.34	2.37	1.94
Mean		56.53 ± 5.31	1.14 ± 0.23	2.72 ± 0.83	2.33 ± 0.85
Panicum	4	63.16	1.44	3.86	3.17
	6	66.73	1.28	3.07	2.52
	8	71.99	1.73	3.81	3.12
Mean		67.29 ± 4.48	1.48 ± 0.23	3.58 ± 0.44	2.94 ± 0.34

Nutritive Value of Hay.

The values for the total digestible nutrients (TDN), the digestible energy (DE) and the metabolizable energy (ME) for the grass hays are presented in Table 4. The mean TDN for C. nlemfuensis var. nlemfuensis and Pennisetum purpureum hays are similar and are higher than those of hays made from the local strain of Cynodon but lower than the mean of hays made from Panicum maximum by about 11 percentage units. Furthermore, both Cynodons are higher in mean TDN (kg/100kg liveweight) than Pennisetum purpureum. The mean energy intake, either in the form of TDN or when expressed in terms of DE or ME, was generally lower for hays made from Cynodon nlemfuensis var robustus and was highest for the Panicum maximum hays.

DISCUSSION

The results of these experiments confirmed the low nutrient associated with tropical grasses particularly the crude protein and the crude fibre. The data obtained could also be influenced by the variety, cultural management handling of the hays before and during storage and the time of harvest. French (1956) working in East Africa reported that the crude protein and the crude fibre content of Panicum maximum, Pennisetum purpureum and Cynodon plectostachyus hays cut at 75-90cm and at flowering stage were 8.86, 8.07 and 9.16; 37.02, 35.82 and 34.86 percent respectively. These values are higher than the corresponding mean values of

6.06, 7.27 and 8.26 percent for the crude protein and lower than the mean values of 42.28, 37.67 and 37.00 percent for the crude fibre contents obtained in the present study for the same species of grasses. The high fibre content and the low crude protein is associated with the more rapid lignification than that which normally occurs in fodders from the cooler zones.

The mean apparent dry matter digestibilities were generally low in the two experiments except for Panicum maximum hays and slightly higher digestion co-efficients obtained for the hays in the second year. In general, the results are in agreement with those of similar experiments reported by some workers elsewher in the tropics. Smith (1962) reported means of 51.7 and 59.5 percent for unferti-lized and N-fertilized veld hay (Hyparrbenia) while French (1956) found that hays made from the three grasses referred to above had dry matter digestibility of approximately 61.8, 64.1 and 62.8 percent respectively. The higher dry matter digestion observed in Panicum maximum at all levels of maturity in the second year cannot be attributed to the lignin content. For earlier work (Olubajo, Van Soest and Oyenuga, 1974) had shown that Pennisetum purpureum had a lower content of grass species. It could however be attributed to the higher content of digestible dry matter it contained (Table 3). It could also be due to longer retention of this species in the reticulo-rumen of the sheep.

The crude protein digestibility coefficient values of the grass hays are low and are slightly lower than the values reported for the same species of grasses with slightly higher crude protein content (French, 1956). Similar observations have been reported of grass hays with crude protein content ranging from 5.1 to 11.5 percent and having dry matter and crude protein digestibilities of 49 to 61.3 percent and 32.6 to 62.6 percent, respectively (Milford, 1960; Todd, 1956; Elliot and Croft, 1958). The rapid reduction of crude protein with age in tropical forages has been attributed to the rapid rate of growth of these plants and the rapid build-up of crude fibre and the encrustation of lignin in them. The performance of animals in terms of liveweight increases depends upon the level of crude protein present in the feedstuff offered. The sheep fed these hays (1973), lost 3.1 g/head/day when fed hays harvested in the 8th week of regrowth. It has shown that the digestibility of herbage crude protein is proportional to the percentage crude protein in the herbage and that the total feed digestibility falls rapidly as the crude protein drops below 5 percent (Glover and French, 1957; Glover, Duthie and Dougall, 1960). It is apparent that the level of crude protein in the herbage is the main factor determining the nutritive value of low quality tropical forages. The loss in weight by the experimental animals fed hays harvested in the 8th week of regrowth is difficult to discern since the percent digestibility of crude protein as well as the CPI and DCPI for grass hays cut at this stage of maturity was higher than in the 4th and 6th week regrowth hays in each treatment.

With the exception of C. nlemfuensis var. robustus hays, the digestibility of crude fibre in other three grass species was high and in all cases it was higher than the digestibility of the nitrogen-free extract. This is to be expected since it is known that tropical ruminants are known to be very efficient in the degree to which they digest crude fibre (Lansbury, 1958; French, 1956). It has been suggested that the probable reason for the apparently high digestibility of the crude fibre in tropical forages lies in the fact that the lignin present in the crude fibre of these forages is more soluble in the reagents used in the analysis of crude fibre and that the lignin not recoverable in the crude fibre is included in the proximate component of the nitrogen-free extract (N.F.E.) This low recovery of lignin in the crude fibre leads to a correspondingly high recovery in the N.F.E., and that this may account for the low digestibility of NFE usually observed in tropical forages (Quarterman, 1961).

The apparent digestibility of the gross energy content of the roughages in the present study did not show any consistent trend with regard to the stage of maturity in all the species of grasses studied. Mba, Oke and Oyenuga (1974) reported increased energy digestibility coefficient with increasing maturity when both sheep and goats were used to study the utilization of a mixture of Cynodon plectostachyus and Centrosema pubescens cut and fed at 6, 8 and 12 weeks of regrowth while Ademosun (1973a) made contrary observation with advancing maturity of Panicum maximum harvested at 4, 7, 10 and 13 weeks of growth using goat as the experimental animal. The probable explanation for the divergent results obtained by the various investigators could lie in the season of the year in which the herbage were harvested.

For it is known that restricted rainfall leads to an inadequate absorption of water and nutrients from the soil and to partial desiccations of the aerial herbage tissues due to rapid respiration rates. With the approach to the dry season, the intervals and intensity of wilting increase, the crude-fibre and the lignin contents rise with the consequent decrease in herbage organic matter digestibility. This explanation may have accounted for the higher crude fibre, lower crude protein contents and lower digestibilities and intakes of dry matter, and nutrients observed in the hays made at 4 weeks of regrowth in Experiment II.

Dry matter and crude protein intakes were low and independent of the stage of maturity (Table 3). This observation is similar to the report of other workers (Ademosun, 1970a, b; Ademosun and Kolade, 1973; Johnson, Hardison, Ordoveza and Castillo, 1968). Johnson et al., (1968) also observed that intake was not closely related to dry matter or crude-fibre content. Minson (1971) found that dry matter intake of three varieties of Panicum maximum decreased with advancing maturity when fed to sheep. The dry matter intake expressed in grammes per kilogramme metabolic weight in this experiment was generally in conformity with the values reported by Haggar (1970) when Adropogon gavanus was fed to sheep without any supplementation. Similar reports have been made by Brinckman (1974) when A. gayanus, Chloris gavana and Stylosanthes guyanensis hays were fed to both the local and crossbred sheep in Northern Nigeria. That the voluntary intake of dry forage such as hay is related to its digestibility is demonstrated by the results of the present study where the intakes of hay dry matter increased by approximately 1.20, 0.47, 0.94 and 3.03 g/unit of digestibility increase when expressed as dry matter intake related to metabolic body size ($kgW^{0.75}$) for treatments M, N, P and Q respectively. These values are not consistent and differ from the values of 0.9 g/unit of digestible energy for sheep given by Blaxter and Wilson (1962, 63).

It is evident that there is a considerable advantage in giving livestock hay of high digestibility since not only is the nutritive value per unit of food high but this is enhanced by an increased intake of the hay when it is offered ad libitum (Murdoch, 1967). Blaxter and Wilson (1962) have also observed that the intakes of apparently digested energy from dried grass was 3.3 times that of straw when the apparent digestibilities of energy of the dried grass and straw were 69.5 and 45.9 percent respectively.

The TDN intake values (kg/100 kg liveweight) increased with increasing maturity for Cynodon nlemfuensis var. robustus while the trends for the other grass hays were not consistent (Table 4). Johnson et al., (1968) using Guinea grass with Holstein bulls and water bufalloes, and Ademosun (1973a, b) using two varieties of Cynodon and Panicum maximum with goats as the experimental animals, reported decreased digestible nutrients intakes with increasing maturity. The mean total digestible nutrients intakes of 1.03 ± 0.10, 0.90 ± 0.19, 1.14 ± 0.23 and 1.48 ± 0.23 kg/100 kg liveweight obtained for treatments M, N, P and Q, respectively, were lower than the value of 1.86 kg/100 kg liveweight for Stylosanthes gracilis reported by Ademosun (1970b) for the maintenance of West African dwarf sheep. When expressed on the basis of ME however, it seems the energy intakes are adequate, for the ARC (1965) put the maintenance ME intake of sheep weighing 30 kg at 1.17 Mcal/day for a ration containing 3.0 Mcal/kg dry matter. All the grass hays resulted in liveweight increases when cut at the 4th and 6th week of regrowth (Means of 1.88 and 1.47 g/head/day). The hays made in the 8th week of regrowth led to losses (1.61 to 3.21 g, mean 2.81 g/head/day) in all the treatments. This may indicate that while the energy level in the hays may be sufficient to meet the daily need of the animals, the amount of crude protein and hence the digestible crude protein in the hays made in the 8th week of regrowth was probably too low for the maintenance of the experimental animals. The ARC (1965) has suggested that all diets for ruminants should contain at least