Effects of Stage of maturity on the Nutritive value of Low Rain Woodland Savannah Pasture

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SUMMARY

Chemical and biological methods were used to determine the effects of stage of development of low rain woodland savannah pasture on its mutritive value. The nutrient composition of pasture herbage, total digestible nutrient (TDN) contents, voluntary dry matter intake (VDMI) and liveweight changes of sheep were determined at three weeks intervals from the time of uniform initial growth of herbage and thereafter for a period of 27 weeks.

The results indicated that percentages of DM, ADF, Lignin and ash of pasture increased significantly (P < 0.05) from 12.5, 32.8, 4.7 and 6.5 at 3 wks age to 86.5, 49.5, 10.7 and 14.2 respectively when pasture herbage was 27 wks old. Boday wieght gain and VDMI of herbage by rams decreased significantly (P < 0.05) as herbage matured. VDMI (g / kg metabolic body size) was 43.5 and 29.8 when herbage age was 3 and 27 wks old respectively. Pasture herbage less than 18 wks supported body weight gains of more than 100g/d. Lambs fed pasture older than 18 wks experienced considerable loss of bodyweight.

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INTRODUCTION

Within the zone, of the low rain woodland savannah, pastureiis the principal feed resource for the national ruminant livestock herd (Harrison, 1955 and Bunderson, 1984).

Empirical evidence indicates that the body condition of grazing livestock is at best during the rainy season when herbage is growing, and it deteriorates during the dry season when pasture ceases to grow. Under the prevailing revailing conditions of the Sudan, hand feeding of harvested and conserved pasture and or supplementation during the dry season seems to provide the most practical and economically feasible alternative feeding systems to effect an all year round sustenance of livestock production. The economics and nature of additional feed supplements however shall depend on the seasonal changes both in quality and quantity of the natural herbage.

This study was, therefore, undertaken to elucidate the change in the nutritive value of natural pasture concomittant with herbage maturity, with the view to highlight the optimum time for hay-making and dry season supplementation of all year round grazing animals.

MATERIALS AND METHODS

The study was conducted during the period June-December, 1985 in the western District of Southern Kordofan Province (Latitude 11 25N and Longitude 29 16E). The area lies in the low rain woodland savannah belt (Hamoon, 1955), on fairly flat and slightly cracking clay soils. During the study year the area recieved 730mm of rain during

the period May-October. The rainy season started with sporadic light showers after mid may and ended before the first week of October. Most of the rains (640mm) were recorded during the months of June, July and August. The highest temperature (47 ˚C) and lowest temperature (9 ˚C) were recorded during the periods May-July and December-February respectively. The relative humidity was highest (70-90%) during the rainy season and lowest (25-40%) during the dry season.

The woody vegetation of the area consists of a mix Soundauian deciduous woodlands and thorny leguminosae (Acacia sp.) and corn-bretacae (Terminalia sp.) The herbacious vegetation is dominated by perrenial grasses major among which are Cynodon dactylon (Negila). Dactyloctenium aegypticusm (Abu Assabie) and Oldlatidia senegalensis (Garagoab).

A plot of one feddan (4200 m), three km to the north west of Lagawa town was selected as the study site. It was used for the provision of pasture herbage samples and fodder for the experimental animals used in the study. The criteria for selection of the study site included ecological representation, dominant land use system and accessibility. The site was fenced with local materials prior to the rainy season and was guarded against tresspassing and communal use throughout the study period.

The study commended when pasture showed initial growth and continued for a period of 27 wks. The study period was divided into nine observation periods of three weeks each. Table 1 shows the native pasture ages (observation periods) and the corresponding calender dates.

Table 1 : Native pasture age and the Corresponding calender date

Pasture age (weeks after initial growth)	Calender dates
3	June 4 - 25
6	June 26 - July 16
9	July 17 - August 6
12	August 7 - August 27
15	August 28 - September 18
18	September 19 - October 9
21	October 10 - October 30
24	October 31 - November 20
27	November 21 - December 11

Herbage for laboratory analysis and for sheep feeding was collected from within the study site by mannually clipping enough amounts using a 0.5x0.5m quadrat during the last 10 days of each of the observation periods. The herbage was clipped 3-5cm above the ground level and herbage regrowth in areas previously clipped was not sampled. A sample of 250g of fresh cut herbage was collected daily and sun-dried. At the end of each observation period the 10 daily herbage samples were thoroughly mixed and a composite sample was kept. for subsequent analysis.

Six three-year old entire male Sudan Desert X Nilotic (Garaj) rams weighing 31.5 ± 1.5kg were used to determine voluntary dry matter intake (VDMI) of herbage and nutrients digestion and utilization during each of the nine observation periods. Prior to experimentation

the rams were drenched with a broad Spectrum anthelmintic, treated for ectoparasites and vaccinated against contagious diseases endemic in the study area.

During the fiist eleven days of each observation period the rams were left free to graze in the vicinity of the fenced study site. This was followed by a ten day feeding and digestibility trial; during which the rams were individually penned and offered herbage ad-lib.

The first five days of each feeding trial were considered a preliminary and adaptation period and the last five days a collection / measurement period. During the latter period, daily samples and amounts of herbage offered and refused and faeces voided by each of the rams were collected and recorded. Daily changes in body weight of the rams were also recorded. Feces wre collected in canvass bags attached to each of the rams by harness. Fecal samples collected were sundried, mixed thoroughly and composite samples for each ram were kept for subseguent analgsis.

Laboratory analysis was conducted two months after the compeletion of the study. Prior to analysis herbage and fecal samples were further dried at 80 °C to constant weight in a forced air oven, ground (1mm screen) then analysed for nutrient contents using standard proximate analysis procedure. (AOAC, 1980); Acid detergent fibre (ADF) and Lignin were determined according to van Soest (1970). Total digestible nutrients (TDN) contents were calculated from the determined apparent digestibility coefficients of the nutrients.

Data of herbage VDMI, apparent digestibility coefficients, TDN and changes in liveweight of rams subjected to analysis of variance (Snedecor and Cochran, 1976) as a randomized compelete block de-

sign with the nine observation periods (herbage age) as blocks and the rams as replicates; When F-tests were significent ($P < 0.05$) Duncans new multiple range test was used to detect differences among blocks means.

RESULTS

The effects of advanced age on the nutrient contents of native pasture herbage is reported in table 2. The herbage contents of DM, CF, ADF, Lignin and ash significantly ($P < 0.05$) increased, while CP, EE and NFE declined with the progress of herbage age. The DM contents of the herbage was less than 40% during the first 15 wks of growth development and increased to over 60% when the herbage was 18 wks old or more. The CP contents was more than 9% when pasture was 18 wks old or less and was less than 6% thereafter. The ADF contents of the herbage amounted to about 50% when it was 18 wks old or more.

The effects of age of pasture on nutrients digestion and its contents of TDN are presented in table 3. Herbage age significantly ($P<0.05$) reduced apparent digestibility coefficients and its TDN contents. The apparent DM digestibility coefficient declined to about 50% when the pasture age was 18wks or more. The TDN contents of the pasture herbage declined to about 50% when the herbage was 24 wks old or more.

Voluntary daily dry matter intake (VDMI) and daily body weight of rams (Table 4) were significantly affected ($P < 0.05$) by herbage age. Maximum daily VDMI per ram (700g) or per unit (kg) metabolic body size (47g) were recorded when the pasture herbage was 12-15

Table 2 : Nutrient composition (% dry matter) of native pasture as affected by stage of maturity.

Nutrient	age of pasture (wks)								
	3	**6**	**9**	**12**	**15**	**18**	**21**	**24**	**27**
Dry matter	12.5	17.6	23.6	28.0	35.9	62.1	73.1	82.2	86.5
Crude protein	18.2	17.5	15.8	13.7	12.6	9.1	6.0	5.3	3.2
Crude fibre	18.3	20.1	23.7	26.8	30.0	33.9	36.9	38.2	39.1
Acid detergent fibre	31.8	32.3	37.4	43.0	45.8	51.9	50.3	49.9	49.5
Ether extract	1.6	1.7	1.3	1.5	1.5	1.3	1.2	0.7	0.6
Nitrogen free extract	55.4	60.7	49.6	47.6	44.8	44.3	43.1	42.0	42.9
Lignin	4.7	6.3	7.0	8.8	9.3	9.3	9.3	10.4	10.7
Ash	6.5	7.9	9.6	10.4	11.1	11.7	12.8	13.8	14.2

Table 3 : Effect of stage of maturity on nutrient digestion and TDN content (%DM) of pasture.

Nutrient	age of pasture (wks)									
	6		9	12	15	18	21	24	27	SE
Dry matter	76.1[a]	75.3[a]	68.1[b]	60.7[c]	54.3[d]	50.6[d]	44.2[e]	38.6[f]	37.7[f]	1.61
Crude protein	80.8[a]	79.5[a]	76.6[b]	73.6[c]	72.4[c]	62.8[d]	53.6[e]	41.9[f]	30.9g	0.57
Crude fibre	81.0[a]	87.2[b]	76.2[c]	71.8[d]	67.7[e]	61.3[f]	56.8g	46.4[11]	44.2[i]	1.08
Ether extract	78.6[a]	793[a]	73.0[a]	77.3[a]	69.9[b]	68.3[b]	50.9[c]	59.1[d]	53.7[d]	3.28
Nitrogen free extract	76.9a		73.3ab	71. 1ab	76.6a	76.4a	72.5ab	,77.5a	76Aa	68.0b	1.93
TDN	74.8[a]	77.3[b]	67.8[c]	67.3[c]	65.3[c]	60.4[d]	59.0[d]	48.2[e]	42.8[f]	1.09

SE = Standard error of the mean

a - i = Means on the same row with different superscipts differ significantly ($P < 0.05$).

Table 4 : Total digestible nutrients (TDN) voluntary dry matter intake (VDMI) and livebody weight changes of rams fed native pasture herbage at various stages of maturity.

Nutrient	**age of pasture (wks)**									
	3	**6**	**9**	**12**	**15**	**18**	**21**	**24**	**27**	**SE**
Total digestible										
Nutrient content (%DM)	74.8[a]	77.3[b]	67.8[c]	67.3c	65.3[c]	60A[d]	u	48.2[e]	42.8[E]	1.09
Voluntary dry matter										
Intake g/d	288.9[a]	605.4[b]	541.9[cf]	733.0[d]	721A[d]	(-146.1[e]	5632[c]	501.6[f]	450.9g	15.77
g/w 0.75 /d	23.6[a]	43.5[b]	45.2[b]	47.2[bc]	49.5[c]	39.o[d]	38.3[de]	35.8[e]	29.8[f]	1.00
Bodyweight gain {g/d)	165.1a	185.7[a]	144.5[ab]	1**56.3**[a]	**121.0**	**111.2**[b]	**-96.0**[c]	-70.'7[c]	-82.5	13.3

SE = Standard error of the mean

a i = Means on the same row with different superscipts differ significantly **(P < 0.05).**

wks old. Rams showed negative bodyweight changes when the pasture offered was older than 18 weeks otherwise body weight changes were positive and amounted to over 100g per day.

DISCUSSION

The increase in the DM content of pasture herbage as it matured is in line with the reports of Butler and Bailey (1973), Miller and Cowlishaw (1976) and Ademosun (1974). This is a result of the progressive accumulation of the product of photosynthesis, absorption of minerals and products of other metabolic processes that occur as the plant grows. It, therefore, coincides with the increase in the cell wall constituents and ash contents of the herbage. The low DM content during the period when herbage was three weeks mature (12.5%) and until it became 15 weeks (39.5%) suggest that DM yield per unit area is low and does not help hay making. This period coincides with high rainfall.

The decline in CP contents of pasture as herbage matures was observed by Herzel and Oxenham (1964) and Lapins and Watson (1969). It was attributed to increased deposition of non nitrogeneous materials concomittant with plant growth and development. William tt 41, (1966) and Zimmerlink gl Al (1972) indicated the marked reduction in the ability of ruminants to consume and digest pasture herbage containing less than 7% CP in the DM. According to the results of this study pasture herbage harvested and or grazed after the age of 18 wks would be less palatable and digestible than if used earlier.

As might be expected the decline in CP contents and the increase

in structural constituents of the herbage were accompanied by a decline in the herbage nutritive value as judged by the TDN values observed. This is in agreement with other reports (Haggar and Ahmed 1970, Mellin el al. 1962, and Reid and Amy 1973).

The investigations of Milford and Minson (1966, 1986), Minson (1971, 1972) and Gihad (1976) attributed the decline, in VDMI of tropical grasses, observed with advanced maturity to dereased. CP contents and increased levels of cell wall materials of the pasture herbage. The range of VDMI reported in this study (24-49g/kg metabolic body size) was not differnt from that observed by Ademosun (1974) for sheep and goats grazing the native pastures of the subhumid Zone of Nigeria.

In the present study the decline in VDMI mediated through changes in the nutritive value of pasture herbage as judged by its TDN contents was accompanied by positive body weight change until 18 weeks of herbage growth. Thereafter there was negative changes in body-weight. In this respect Salih (1986) reported that feeds with less than 50% DM digestibility failed to meet the nutrient requirement of cattle.

In conclusion it may be argued that livebody weight changes (Table 4) observed in this study indicate that pasture herbage is capable of promoting productivity of sheep for a period of 18 weeks from the time of initial growth. To sustain productivity of grazing sheep, thereafter, an energy-protein supplement had to be provided from that time onwards as the dry season progresses.

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