The intake and digestibility by cattle of cereal and legume forages .grown in the irrigated areas of the Sudan.

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Summary

With the introduction of forages in the crop rotation of the agricultural schemes a thorough knowledge of their feed value for economic livestock intensification systems is necessary. Four forages, namely Berseem *(Medicago sativa), Clitoria (Clitoria ternata),* Forage sorghum *(Sorghum vulgare* var. Abu 70) and Forage sorghum Hybrid Pioneer 988, were -investigated for their intake and digestibility by cattle. The DM intake of the legume forages was significantly ($P < 0.001$) higher than the cereal forages. The order from high to low was Berseem, Clitoria, sorghum hybrid and Abu 70. Expressed as % of liveweight the DM intakes were 5.1, 3.6, 2.5 and 1.9 respectively. The DM digestibility of the legume forages was significantly ($P < 0.01$) higher than the cereal forages. In all component, Berseem had the highest digestibility. Between the cereal forages Abu 70 had a higher digestibility of DM, OM and CP than sorghum hybrid. The CF digestibility of sorghum hybrid was significantly ($P < 0.001$) higher than that of Abu 70 and Clitoria and not significantly from that of Berseem. Particularly noticeable was the significantly ($P < 0.001$) very high digestibility of the crude protein of the legume forages

(82 and 86%) as compared to that of the cereal forages (40 and 48%).

Introduction

In a previous paper, Ahmed and El Khider (1992) pointed out that there is strong plea for forages to be an integral component of the crop rotation if the recent policy of livestock integration in the agricultural schemes is to be implemented. During the last four years a 5-course rotation including forages had cautiously and narrowly been tried in 5000 feddans in the Central Block of the Gezira Scheme (Sudan Gezira Board, 1994).

Forages constitute a major source of feed for the livestock specially in dairy enterprises.

In many irrigated areas where supplementary sources of feeds are expensive or unavailable forages form the entire ration. Computation of rations to meet the nutritional requirements to certain levels of performance needs a sound knowledge of the nutritive value of these forages.

The aim of this experiment was to study the intake by cattle and digestibility of some of the forages likely to be grown in these areas. The experiment was conducted at the University of Gezira Farm, Nisheishiba, Wad Medani.

Materials and Methods

Forages:

Four forages namely Forage sorghum *(Sorghum vulgare* var. Abu 70), Sorghum hybrid (Pioneer "988"), Berseem *(Medicago sativa)* and *Clitoria ternata* were studied for intake and digestibility by cattle. Abu 70 was sown in June and received two doses of nitrogen fertilizer. The first cut was

obtained in the second week of August. The second and third cuts were used in this trial. Berseem was sown in October, no fertilizer was applied and the third and fourth cuts were used. Clitoria was sown in December, nitrogen fertilization was applied and the second cut was used. The tops of Abu 70 and the sorghum hybrid forage were removed before they were offered to the animals.

Animals and management:

Six Kenana X Friesian cross-bred bulls of 15 - 18 months of age and of an average liveweight of 180 kg were used. The animals were housed under shed in a pen of 5 x 2.5 x 3.5 metre in length, width and elevation respectively. The pen was partitioned into six separate cubicles by metallic bars. A wire mesh separated the adjacent feed troughs to avoid mixing feeds. The animals were tied to the former 'bars with thick nylon ropes loosely hanging from their necks to allow them to lie down comfortably. Water was available at all time. The animals were dosed with an anthelmintic and weekly sprayed with an acaricidt. The pens were cleaned twice a week.

Experimental procedure:

The animals were offered the fresh forage as it was cut daily from the field to an *ad libitum* level for an adaptation period of several days. This was followed by a period of two weeks during which the level of forage intake by each animal was carefully adjusted and accurately determined. All freshly offered forages and residues were daily weighed to the nearest 50 grammes. At the end of this period the animals were prepared to the collection period.

Canvass harnesses of long belts each of 35 cm length ending in buckles were tied around the back, both sides and the abdomen of the animal. The harnesses were tied together with clip-like buckles for adjustment to the body size. They were put two days prior to the next faecal collection period for adaptation. A digestibility bag made of strong non-porous nylon cloth was then fixed with belts to the end of the harness of each animal. The bags were impermeable to moisture.

Ten days were allowed for the collection period The faeces were collected in the bags and were emptied once a day. Before emptying, each bag was weighed and the weight of the faeces for each animal was recorded. The faeces, for each animal, were thoroughly mixed and a representative sample was taken to dry matter determination. Dried faecal samples for each animal and for the whole period of collection were pooled, mixed and a representative sample was taken for chemical analysis.

The chemical analysis of the forages residues and faeces for crude protein and crude fibre were determined using the standard methods adopted by the Association of Official Analytical Chemists (1975).

The data on the intake and digestibility was subjected to a 2-way analysis of variance and the treatment means were separated according to orthogonal contrast.

Results

The chemical composition of the four forages under study is shown in Table 1. Particularly noticeable is the high crude protein content of Berseem (214 g/kg DM), and the low crude protein content (27 gikg DM) of the sorghum hybrid forage.

Table 1: Dry matter (DM g/kg) and the chemical composition (g kg DM) of the experimental forages.

Forage	DM	Ash	Crude Protein (Nx6.25)	Crude Fibre
Forage sorghum (Abu 70)	300	57	35	286
Sorghum hybrid (Pioneer 988)	280	77	27	304
Clitoria	300	76	175	279
Berseem	270	118	214	215

The mean values for the dry matter (DM) intake of the four forages are shown in Table 2. Generally the DM intake of the legume forages was significantly ($P < 0.001$) higher **than that of the cereal forages. Between the cereal forages no significant difference in intake was observed although the animals on sorghum hybrid tended to eat more of the forage. The intake of Berseem was significantly ($P < 0.01$) higher than of Clitoria. When expressed as a percentage of the average liveweight, the bulls on forage sorghum had the lowest intake (1.9%) while those on Berseem had the highest intake (5.1%).**

Table 3 shows the apparent digestibilities of dry matter (DMD), organic matter (DOM), crude fibre (DCF) and crude protein (DCP) of the four forages tested. The digestibilities of the different forage components of the legume forages were significantly ($P < 0.001$) higher than the cereal forages.

Table 2: Average values ± SD for intake of different forages fed to bulls expressed as kg DM/day, g/kg $LW^{0•75}$ and as % of liveweight (LW).

Parameter	Forage sorghum (Abu 7 0)	Sorghum hybrid Pioneer 988	Clitoria	Berseem	S.D.
Average liveweight (kg)	185.0	188.3	195.5	195.7	
Average metabolic weight (kg LW^{0-75})	50.1	50.9	52.2	52.3	
Intake kg DM	3.49 ± 0.237	4.62 ± 0.154	7.22 ± 0.091	9.90 ± 0.46	0.18
S.E.		0.146		0.153	
Intake DM/kg $LW^{0•75}$	69.7± 4.73	90.8± 3.03	138.3± 1.74	189.0± 8.79	
Intake (% LW)	1.9	2.5	3.6	5.1	

Table 3: Apparent digestibility coefficients (%) ± S.D. of the dry matter (DMD), organic matter (DOM), crude fibre (DCF) and crude protein (DCP) of the four experimental forages.

Parameter	Forage Sorghum (Abu 70)	Sorghum hybrid (988)	Clitoria	Berseem	S.E. of diff.	Level of sign.
DMD	65.7 ± 1.13	61.5 ± 1.38	70.5 ± 1.22	72.6 ± 1.22	0.380	***
DOM	68.1 ± 1.22	62.9 ± 1.19	73.2 ± 1.23	76.0 ± 1.32	0.377	***
DCF	61.6 ± 1.97	65.9 ± 1.55	61.7 ± 1.97	66.5 ± 1.47	0.520	***
DCP	48.7 ± 1.11	40.1 ± 1.18	82.3 ± 1.31	86.3 ± 1.40	0.528	***

*** means significant at $P < 0.001$

Berseem had a higher ($P < 0.001$) digestibility than Clitoria. Between the cereal forages Abu 70 had a higher digestibility ($P < 0.001$) than sorghum hybrid forage in all components except the DCF which was higher ($P < 0.01$) in the latter than the former.

Discussion

The differences in the dry matter intake of the different forages observed in this study could be explained by the differences in their palatability and physical form. Van Soest (1964) reported that when the total fibrous fraction of a forage exceeds 55-60% of the DM, it limits the voluntary feed intake. This was not the case in this study since the four forages tested had a crude fibre content ranging between 214303 g/kg DM.

The high DM intake (g/kg $LW^{0.75}$) of the legume forages compared to the cereal forages could be attributed to the superior quality of the former (high protein content). This supports the findings of Ahmed and Ahmed (1983) in their studies of similar forages with Zebu cattle. Low protein content of diets are well known to limit feed intake (Smith, 1962; Elliot and Topps, 1963; Haggar and Ahmed, 1970). Low intakes of cereal forages were reported to result from their high cell wall content (Mertens, 1978; Osbourn *et al.*, 1974) and due to rumen fill as a result of their bulkiness (Fell *et al.*, 1964; Tulloh, 1966). Sorghum hybrid forage, though leafier was of a thicker stem than Abu 70. Clitoria had thicker stems than Berseem.

In this study the DMD of the legume forages (Clitoria and Berseem) were significantly ($P < 0.001$) higher than the DMD of the cereal forages. With similar forages, Ahmed and

Ahmed (1983) found no significant difference in the DMD between Berseem and Abu 70. The values for the organic matter digestibilities reported in this experiment are lower for sorghum forage Abu 70 and higher for Berseem than those obtained by Ahmed and Ahmed (1983). This might be due to the different stages of maturity (different cuts) and the difference in nutrient components (e.g. the CP was 161 and 63 g/kg DM for Berseem and Abu 70 in their studies, whereas it is 214 and 35 g/kg for the respective forages in this study In this respect it is very interesting to note the very high digestibility of the crude protein of the legume forages (82 and 86%) as compared to that of the cereal forages (40 and 48%). The higher fibre content in the cereal forages than that in the legume forages contributed to the low digestibility of the former forages. Van Soest (1965) stated that as the fibre fraction of the forages increases its digestibility decreases. Olubajo, Van Soest and Oyenuga (1974) in their study of digestibility of tropical forages in Nigeria found no significant relationship of digestibility to any compositional parameters. In this study no direct relationship between the chemical composition of the forage and its digestibility was observed, however there was a tendency for an increased digestibility with the increase in the crude fibre and more noticeable in the crude protein content.

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