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# INTAKE AND QUALITATIVE ASPECTS OF GUINEA GRASS GRAZED BY SHEEP OVER THREE DIFFERENT SEASONS

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## Abstract

The objective of this study was to determine the influence of season on intake by sheep as well as certain selected qualitative characteristics of *Panicum maximum* (cv Gatton) (Guinea grass) at the mature growing stage. The lower DM content of the spring and summer grass (41.6 and 40.2%) did not hamper DOMI (48.1 and 26.7 $W^{0.75}$/d), respectively. The N concentration of the spring and summer grass was well within the limit required for optimal rumen microbial production (1.8 - 2.0%). The high cell wall components of the winter grass resulted most probably in a significant lower IVDOM value (55.5%). The IVDOM values of the spring and summer grass (65.3 and 62.3%) were on the high side for a sub-tropical grass. The lower N content of the summer and winter grass resulted in subsequent lower rumen $NH_3$-N levels (8.9 and 5.3 mmol/100 mL). The winter rumen $NH_3$-N level could have been marginal in terms of rumen microbial activity. The lower VFA values of the summer and winter grass (13.7 and 12.0 mmol/100 mL), could have resulted from a low carbohydrate content in comparison with the N content of these grasses. The significant lower acetic:propionic acid ratio (4.1) of the spring grass suggested a higher quality than both the summer and winter grass ratios (4.6 and 4.7). The significant higher

DOMI of the spring pasture (48.1 g/$W^{0.75}$/d) suggested a potential growth rate of 200 g + of 30 kg lambs.  Both the DOMI values of the summer and winter grass (26.7 and 23.3 g/$W^{0.75}$/d) should fulfill at least the maintenance requirements of grazing sheep.

**Keywords**:   *P. maximum*, sheep, intake, quality, rumen

## Introduction

In the drier summer rainfall areas of South Africa, animal production may be limited on already degraded rangelands.  This is most probably due to poor digestibilities which resulted in low intakes (Minson & McLeod, 1970).  *Panicum maximum* is one of the most important forage species in the Savanna grassland areas of South Africa and is used as a cultivated dry land pasture to relieve grazing pressure on degraded rangeland.

## Material and Methods

The study was conducted at the Experimental farm of the University of Pretoria.  The area has an exclusively summer rainfall of ∀ 650 mm per annum, dry late autumn and winter and has an altitude of 1370 m.  Summer temperatures are 12°C (min) to 30°C (max), with mild frost in the winter.  Guinea grass (*Panicum maximum*, cv Gatton) was established under dry land conditions.  The pasture was fertilized with 112 kg of N once during October just as the rainy season started.  Measurements were done during the different seasons (spring, summer and winter) on intake, certain qualitative aspects of the selected grass as well as certain rumen parameters.  Only the adult stage of maturity (84 days of regrowth) was investigated.

Five Dorper wethers were fitted with oesophageal cannulae.  Intake of the pasture was determined by the ratio faeces voided in collection bags and the indigestibility of oesophageal samples calculated from the *in vitro* technique (Tilley & Terry, 1963). *In vitro* values were converted to expected *in vivo* digestibility of organic matter (OM)), according to Engels *et al*. (1981).

Experimental animals were adapted to the pasture over 14 days during each season. The oesophageal extrusa was collected after animals fasted for three hours. Aliquots of all samples were frozen in plastic bags and stored until analyzed. All samples were analyzed according to standard laboratory procedures.

The Prog GLM procedure of SAS (1985) was used to test for differences between seasons.

## Results and Discussion

The quality of oesophageal selected material is shown in Table 1.

The lower DM content of the spring and summer grass was expected, but did not seem to hamper intake because of a too high water content, judging to the digestible organic matter intake (DOMI) values of Table 2. The nitrogen (N) content of the spring and summer grass was significantly higher than that of the winter grass, as expected. The 2% N of the spring grass is well within the limit set by Satter & Slyter (1974), whom suggested that if the N-content of a grass should rise above 2.5% on a DM basis, too much N will be lost through ammonia-N in the rumen, which will cause a drop in microbial protein production. On the other hand, the lower N content of the winter grass, is still high enough to satisfy the maintenance requirements of sheep, if DM is high enough (NRC, 1985). The higher cell wall components of the winter grass, were most probably responsible for the significantly lower *in vitro* digestible organic matter (IVDOM) value of that grass. The IVDOM values of the spring and summer grass were fairly high for a subtropical grass, and was most probably due to the fact that the sheep were allowed to select freely. The higher cell wall content of the summer grass in comparison with the spring grass, could have been resulted from the higher environmental temperatures during the growth stage (Wilson *et al*., 1991). The higher ADL value of the winter grass compared favourably with values of other tropical grasses, as reported by Van Niekerk (1997).

Certain rumen parameters as well as the DOMI of Guinea grass over three seasons, are shown in Table 2.

The significant lower ammonia-N ($NH_3$-N) values in the rumen fluid of the winter and summer grass in comparison with the spring grass, were expected. This correspond well with the lower N-values of the summer and winter grass. The lower $NH_3$-N value of the winter grass could have been marginal in terms of rumen microbial activity, as Satter & Roffler (1977) proposed a minimum value of 5 mg/100 mL rumen fluid for normal rumen microbial activity.

The volatile fatty acid (VFA) values differ significantly between the seasons with the winter value the lowest, as expected. Both the lower VFA values of the summer and winter grass, could have been due to a lower water soluble carbohydrate content in comparison with the N content of that respective grass. According to Beever *et al*. (1978) such an imbalance can be the reason for a lower VFA production in grasses. Although the smaller acetic:propionic acid ratio of the spring grass suggested a higher quality than the summer and winter grass, no significant differences were found for the molar proportions of propionic acid between the different seasons. It is a well-known fact that spring pastures do have higher concentrations of water soluble carbohydrates in comparison with summer and autumn grown pastures (Givens *et al*., 1993).

The DOMI of the spring grass was significantly higher than that of both the summer and winter grass. This correspond well with the respective NDF and ADF values. Van Soest (1965) found a negative correlation (r = - 0.65) between NDF and voluntary intake and Jones & Walters (1975) a negative correlation (r = - 0.90) between ADF and voluntary intake. It has to be kept in mind that the correlations between NDF and intake are generally lower for subtropical than for temperate forages (Rohweder *et al*., 1978). According to the ARC (1980), a growth rate of 200 g +/day in 30 kg lambs, is possible on the spring grass based on the DOMI value, if all other nutrients are sufficient. In this respect, both the summer and winter grasses are below the suggested 33 g DOMI/kg $W^{0.75}$, which is necessary for a growth rate of 90 g/day, but is still sufficient for maintenance (ARC, 1980).

It was concluded that the potential of Guinea grass should be satisfactory to sustain sheep production throughout the year, with even an active growth during the spring period. Supplementary feeding should be necessary to optimize the utilization of the summer and winter grasses for productive sheep. The best quality, as expected, was obtained from the spring grass.

## References

**A.R.C.** (1980). The nutrient requirements of ruminant livestock. Commonwealth Agricultural Bureaux, Farnham Royal.

**Beever, D.E., Terry R.A., Cammell S.B. and Wallace A.S.** (1978). The digestion of spring and autumn harvested perennial ryegrass by sheep. J. Agric. Sci. **90**: 463-470.

**Engels, E.A.N., De Waal H.O., Biel L.C. and Malan A.** (1981). Practical implications of the effect of drying and treatment on nitrogen content and *in vitro* digestibility of samples collected by oesophageally fistulated animals. S. Afr. J. Anim. Sci. **11**: 247-254.

**Givens, D.I., Moss A.R. and Adamson A.H.** (1993). Influence of growth stage and season on the energy value of fresh herbage. 1. Changes in metabolizable energy content. Grass Forage Sci.

**48**: 166-174.

**Jones, D.I.H. and Walters R.J.K.** (1975). Structural constituents of grasses in relation to digestibility and voluntary intake. J. Sci. Food Agric. **26**: 1436-1437.

**Minson, D.J. and McLeod M.N.** (1970). The digestibility of temperate and tropical grasses. Proc. XIth Int. Grassl. Congr. Surfers Paradise, Australia. 719-722.

**N.R.C.** (1985). The nutrient requirements of domestic animals. Nutrient requirements of sheep. National Academy of Science, Washington, D.C.

**Rohweder, D.A., Barnes R.F. and Jorgensen N.** (1978). Proposed hay grading standards based on laboratory analyses for evaluating quality. J. Anim. Sci. **47**: 747-759.

**S.A.S. Users Guide** (1985). S.A.S. Institute Inc. Raleigh, North Carolina.

**Satter, L.P. and Roffler R.E.** (1977). Influence of nitrogen and carbohydrate inputs on rumen fermentation. Ch. 3 in Recent Advances in Animal Nutrition, Haresign and Lewis eds. Butterworths, London.

**Satter, L.P. and Slyter L.L.** (1974). Effect of ammonia concentration on rumen microbial protein production *in vitro*. Br. J. Nutr. **32**: 199-208.

**Tilley, J.M.A. and Terry R.A.** (1963). A two-stage technique for the *in vitro* digestion of forage crops. J. Brit. Grassl. Soc. **18**: 104-111.

**Van Niekerk, W.A.** (1997). Intake and partial digestibility of a number of forages by sheep and the use of some quality parameters to predict intake. Ph.D. thesis, University of Pretoria.

**Van Soest, P.J.** (1965). Symposium on factors influencing the voluntary intake of herbage by ruminants: Voluntary intake in relation to chemical composition and digestibility. J. Anim. Sci. **24**: 834-843.

**Wilson, J.R., Deinum B. and Engels F.M.** (1991). Temperature effects on anatomy and digestibility of leaf and stem of tropical and temperate forage species. Neth. J. Agric. Sci. **39**: 31-48.

**Table 1** - The quality of selected material of sheep grazed Guinea grass during spring, summer and winter (DM basis).

| Parameters | Spring | Summer | Winter | $SE_m$* |
|---|---|---|---|---|
| DM (%) | $41.6^b$ | $40.2^c$ | $88.1^a$ | 0.3 |
| N (%) | $2.0^a$ | $1.8^a$ | $1.5^b$ | 0.1 |
| NDF (%) | $54.1^c$ | $59.5^b$ | $63.8^a$ | 0.4 |
| ADF (%) | $28.9^c$ | $30.8^b$ | $35.7^a$ | 0.4 |
| ADL (%) | $4.2^b$ | $4.1^b$ | $5.6^a$ | 0.1 |
| IVDOM (%) | $65.3^a$ | $62.3^b$ | $55.5^c$ | 0.6 |

*$SE_m$ = Standard error of the mean
$^{a,b,c}$ = Means in a row follow by a different letter, differ significantly (P#0.05)

**Table 2** - Certain rumen parameters and intake of sheep grazed Guinea grass during spring, summer and winter (DM basis).

| Parameters | Spring | Summer | Winter | $SE_m$ |
|---|---|---|---|---|
| $NH_3$-N (mg/100 mL) | $17.3^a$ | $8.9^b$ | $5.3^c$ | 0.7 |
| VFA (mmol/100 mL) | $18.5^a$ | $13.7^b$ | $12.0^b$ | 0.8 |
| Molar proportions: | | | | |
| 1. Acetic acid | $0.71^b$ | $0.74^a$ | $0.74^a$ | 0.005 |
| 2. Propionic acid | 0.17 | 0.16 | 0.16 | 0.005 |
| 3. Butyric acid | 0.11 | 0.10 | 0.10 | 0.006 |
| Acetic:Propionic acid | $4.1^b$ | $4.6^a$ | $4.7^a$ | 0.1 |
| DOMI (g/kg $W^{0.75}$/d) | $48.1^a$ | $26.7^b$ | $23.3^b$ | 1.2 |