NUTRITIVE VALUE OF GUINEAGRASS CULTIVARS IN THE WINTER AS INFLUENCED BY NITROGEN FERTILIZATION

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ABSTRACT

The monitoring of yield, structure and nutritive value of four *Panicum maximum* (Guineagrass) cultivars, utilized as standing hay in the winter, yielded valuable data on the relative importance of nitrogen fertilization and cultivar. While nitrogen had a strong influence on yield and crude protein content it was the differences between cultivars, with respect to soil adaptation and structure, which played a dominant role. It is recommended that future research place particular emphasis on the adaptation of cultivars and genotype differences in structure.

KEYWORDS

Digestibility, leafiness, nitrogen, *Panicum maximum*, standing hay

INTRODUCTION

Guineagrass (*Panicum maximum*) is widely distributed in the warmer areas of southern Africa (Van Oudtshoorn, 1991). Its value has been recognized by Grunow et al., (1977) and Du Pisani et al. (1986) and a range of aspects have been researched in recent years (Rethman et al., 1991; Van Niekerk et al., 1991; Viljoen, et al., 1991; Van Niekerk et al., 1993; Pieterse et al., 1994). This work was conducted with the cultivar Gatton. Rethman et al. (1996) emphasized the importance of cultivar choice. This is of particular relevance in production systems using foggage in the winter months. Such low input production systems are becoming increasingly popular amongst developing farmers. As a follow-up to work of Rethman et al. (1996) and Rethman and deWitt (1993), who reported on the influence of N fertilization on kikuyu foggage, it was decided to investigate the influence of nitrogen on the foggage value of Guineagrass cultivars. This was assessed in terms of yield, structure, crude protein, fibre and digestibility.

METHODS

Two blocks of four cultivars (Gatton, Green Panic, Mutale and Vencedor) were established on two sites. The one, a bottomland, had a sandy clay soil with slightly impeded drainage, while the other, an upland, had a well drained sandy clay loam. Phosphorous and potassium fertilization was based on soil analyses. In November 1994 two levels of nitrogen fertilization (50 and 100 kg Nha^{-1}) were applied. After a hay cut in January 1995 each sub-plot was sub-divided and three levels of nitrogen (0, 50 and 100 Nha^{-1}) applied. The late season growth, which was evaluated in July 1995, received six levels of nitrogen, namely: the effect of 50 kg Nha^{-1} in spring plus 0, 50 and 100 kg Nha^{-1} in summer and the effect of 100 kg Nha^{-1} in spring plus 0, 50 and 100 kg Nha^{-1} in summer.

Material was dried at 60½C, and separated into leaf and stem to ascertain the influence of fertilization and cultivar on yield and structure. The crude protein content was based on the N content, as determined using the macro-Kjeldahl method (Anon., 1980). The NDF (neutral detergent fibre), ADF (acid detergent fibre) and IVDOM (*in vitro* digestibility of organic material) of leaf and stem, from treatments which received 50 kg Nha^{-1} in spring and 100 kg Nha^{-1} in summer, was also determined. These determinations were based on the techniques of Van Soest and Wine (1967), Van Soest (1963) and Tilley and Terry (1963) (as modified by Engels and van der Merwe (1967), respectively.

RESULTS AND DISCUSSION

Dry matter yields (Table 1) were markedly affected by soil type, cultivar and level of N. Average yields on the upland site were 18% better than on the bottomland site. There was, however, an interaction between cultivar and site. Gatton and Mutale yielded more (49% and 105% respectively) on the upland site, while Green Panic and Vencedor recorded higher yields (10% and 28% respectively) on the bottomland site. Overall, there were small differences between Mutale (4.4 tha^{-1}), Vencedor (4.3 tha^{-1}) and Green Panic (4.0 tha^{-1}) but Gatton recorded only 3.4 tha^{-1}. With respect to responses to N, the response to spring fertilization (50 vs 100 kg Nha^{-1}) was minimal (3.9 and 4.1 tha^{-1} respectively) but summer fertilization had a marked effect. Fifty kg Nha^{-1} increased yields by 38%, while 100 kg $N.ha^{-1}$ resulted in a 62% improvement.

Although only average figures for **leafiness** were obtained, it was notable that Vencedor had 70% leaf, while Green Panic had only 37%. Gatton (49%) and Mutale (47%) were intermediate. These results have a strong influence on the yield of leaf material. Livestock select very strongly for leaf. On the basis of leaf yield Vencedor, Mutale, Gatton and Green Panic yielded 3.0, 2.1, 1.7 and 1.5 $tDMha^{-1}$ respectively.

In terms of **nutritive value** it is evident that **crude protein** (CP) was markedly influenced by component and level of N, but that there were no marked differences between cultivars. Leaves had, on average, a CP content of 7.4% while that of stem material was only 3.9%. While the CP content of leaves increased with increasing levels of N it would appear that the CP of stems was unaffected! The protein yield of cultivars consequently differed markedly. Vencedor, with 275 kg CP, and Mutale, with 247 kg CP, outyielded Green Panic and Gatton, with 195 and 192 kg CP respectively.

Fibre components (ADF and NDF) and **digestibility** (IVDOM) differed between leaf and stem components but there were no marked cultivar differences. The percentage leaf, therefore, had a marked influence on the final yield of digestible nutrients. While Vencedor yielded 1860 kg digestible OM, in the form of leaves, Mutale, Gatton and Green Panic produced 1323, 1088 and 960 kg respectively.

CONCLUSIONS

While nitrogen fertilization has a marked influence on yield and CP content it is evident that future research should place emphasis on the adaptation of cultivars to different conditions and genotype differences in leaf:stem ratios.

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Table 1
Influence of nitrogen fertilization on yield (tha^{-1}) and structure (% leaf) of four *Panicum maximum* cultivars evaluated as standing hay in the winter.

Cultivar	**kg Nha^{-1} in summer**				**% Leaf**
	0	**50**	**100**	**Mean**	
Gatton	2.41	3.09	4.56	3.35	49.4
Green Panic	2.82	4.35	4.92	4.03	37.4
Mutale	3.69	4.44	5.07	4.40	46.8
Vencedor	3.10	4.73	5.00	4.28	69.9
Mean	3.01	4.15	4.89		

Table 2
Nutritive value of *Panicum maximum* cultivars in mid-winter **%.**

Crude Protein.

Cultivar	**Component**	**Level of N (kg Nha^{-1})**			
		0	**50**	**100**	**Mean**
Gatton	Leaf	6.5	7.1	7.7	7.1
	Stem	3.9	4.1	4.7	4.2
Green Panic	Leaf	7.3	7.1	7.6	7.3
	Stem	4.0	3.1	3.2	3.4
Mutale	Leaf	6.3	7.1	9.7	7.7
	Stem	3.4	4.0	3.7	3.7
Vencedor	Leaf	6.5	-	8.0	7.3
	Stem	4.2	4.2	4.5	4.3
Mean	Leaf	6.7	7.1	8.3	
	Stem	3.9	3.9	4.0	

Fibre & Digestibility

		% ADF	% NDF	% IVDOM
Gatton	Leaf	28.2	64.0	63.8
	Stem	39.3	76.9	57.7
Green Panic	Leaf	30.7	67.5	63.5
	Stem	41.9	76.0	53.6
Mutale	Leaf	31.0	67.7	62.8
	Stem	42.1	78.2	54.8
Vencedor	Leaf	28.9	62.4	61.5
	Stem	38.3	74.8	50.8
Mean	Leaf	29.7	65.4	62.9
	Stem	40.4	76.5	54.2