

Certain qualitative characteristics of *Boscia foetida* at different sites in South Africa

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Abstract

The aim of this study was to quantify the suitability of *Boscia foetida* as a fodder source for goats. Samples of leaves and twigs were taken in the Northern Cape and Limpopo provinces of South Africa. The concentrations of Ca, Mg, and Mn in leaves and stems were sufficient for production, but both leaves and stems lack in P, Cu and Zn. Crude protein values ranged from 96 g /kg DM for stems to 187 g /kg DM for leaves. Neutral detergent fibre and acid detergent lignin values ranged from 507 g /kg DM and 136 g /kg DM for leaves to 760 g /kg DM and 222 g /kg DM for stems respectively. The *in vitro* digestible organic matter concentrations varied between 203 g /kg DM to 479 g /kg DM for stems and leaves respectively. The results indicated that *Boscia foetida* will make a useful contribution to most of the nutrient requirements of goats.

Keywords: *Boscia foetida*, crude protein, NDF, ADL, *in vitro* digestibility, minerals

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Introduction

Overgrazing and poor management led to erosion and desertification in arid and semi-arid areas, resulting in the reduction of income and destabilization of rural communities. *Boscia* spp. (Shepherd's tree) has been identified as a fodder source well adapted to the arid and semi-arid regions of South Africa. According to Le Riche & Van der Walt (1999) it is one of the most important forage trees in the Kalahari. *Boscia* trees are important for animal production due to their deep root system which enables them to take up minerals and access ground water during droughts (Topps, 1992). According to Lu (1988) it is well established that goats can survive and indeed flourish in areas where cattle and sheep cannot. The objective of this paper is to report on the suitability of *Boscia* spp. as a fodder source for goats.

Materials and Methods

Nine samples (trees) of edible material (twigs up to 4 mm in diameter, and leaves) of *Boscia foetida* were collected at three sites in South Africa during February 2003. Samples were taken from mature trees. The sites were Kenhardt, Northern Cape Province, situated at 21°14'E; 29°36'S at an altitude of 789 m with an average rainfall of 155 mm; Klein Pella, Northern Cape Province, situated at 19°15'E; 29°03'S at an altitude of 836 m with an average rainfall of 89 mm; and Marken, Limpopo Province, situated at 23°58'E; 27°58'S at an altitude of 849 m with an average rainfall of 445 mm. The samples were air dried, leaves and stems were separated, milled and then analysed for the following: *In vitro* digestible organic matter (IVDOM) according to the method of Tilly & Terry (1963) as modified by Engels & Van der Merwe (1967), crude protein (CP) and macro and trace minerals (AOAC, 2000), neutral detergent fibre (NDF) (Robertson & Van Soest, 1981) and acid detergent lignin (ADL) (Goering & Van Soest, 1970).

An analysis of variance with the Proc GLM model (SAS, 1994) was used to determine the significance between different areas, leaves and stems. Least square means and standard deviations (s.d.) were calculated. Significance of difference (5%) between means was determined by multiple comparisons using Bonferroni's test (Samuels, 1989).

Results and Discussion

The CP concentration of stems varied from 96 g/kg at Kenhardt to 150 g/kg at Marken ($P < 0.05$). The highest CP concentration for leaves (187 g/kg) was recorded at Klein Pella and it was significantly higher

than the CP concentration of leaves collected at Kenhardt (133 g/kg). The CP concentration of *Combretum* spp. foliage ranged from 62 g to 125 g/kg DM and that of *Colophospermum mopane* from 99 to 169 g/kg DM (Lukhele & Van Ryssen, 2003). These compared favourably with that of the reported *Boscia* leaves. Neutral detergent fibre concentrations in *B. foetida* leaves were higher than the range reported by Lukhele & Van Ryssen (2003) for *Combretum* spp. (279 g – 409 g/kg DM) while the ADL concentrations in *B. foetida* leaves were also higher than the reported values of Lukhele & Van Ryssen (2003) for the *Combretum* spp. and *C. mopane*. High NDF and ADL values of *B. foetida* will most probably have a negative influence on digestibility and intake of such material by grazing herbivores. The higher IVDOM values of the *Boscia* leaves, in comparison to stems, are important. It is reported that leaves have a shorter rumen retention time compared to stems (Minson, 1982), which may permit more dry matter to be consumed if mainly leaves are browsed. According to Tetthen, (1974), as cited by NRC (1981), goats are selective feeders and will select leaf material before browsing on stems of a specific fodder. The Ca, P, Mg, Cu, Zn and Mn concentrations are presented in Table 2.

Table 1 Mean (\pm s.d.) chemical composition of *Boscia foetida* at different sites (g/kg DM)

Site		CP	NDF	ADL	IVDOM
Marken	Leaf	183 ^a (46.3)	507 ^b (63.6)	168 ^a (10.4)	458 ^a (4.8)
	Stem	150 ₂ (17.0)	760 ₂ (15.5)	222 ₁ (10.5)	215 ₁ (1.6)
Kenhardt	Leaf	133 ^b (6.0)	575 ^b (17.1)	136 ^a (9.6)	462 ^a (1.2)
	Stem	96 ₁ (8.8)	648 ₁ (7.1)	159 ₁ (7.5)	228 ₁ (3.2)
Pella	Leaf	187 ^a (6.8)	536 ^b (67.4)	153 ^a (4.0)	479 ^a (5.5)
	Stem	109 ₁ (11.5)	641 ₁ (11.5)	201 ₁ (40.5)	203 ₁ (4.1)

Column for leaves (a,b) and stems (1,2) means with common scripts do not differ significantly ($P > 0.05$)
 CP - crude protein; NDF - neutral detergent fibre; ADL - acid detergent lignin;
 IVDOM - *in vitro* digestible organic matter

Table 2 Mean (\pm s.d.) macro-mineral (g/kg DM) and trace mineral (mg/kg DM) concentrations of *Boscia foetida* at three sites

		Ca	P	Mg	Cu	Zn	Mn
Marken	leaf	5.5 ^a (2.1)	0.89 ^a (0.4)	3.8 ^a (0.3)	9.8 ^a (5.0)	13.0 ^a (1.7)	114 ^a (13.8)
	stem	3.2 ₁ (0.8)	0.60 ₁ (0.2)	0.9 ₁ (0.1)	8.2 ₁ (1.7)	13.4 ₁ (3.2)	29.3 ₁ (8.3)
Kenhardt	leaf	6.2 ^a (0.1)	0.56 ^a (0.1)	1.0 ^b (0.1)	3.0 ^b (0.1)	15.3 ^a (4.0)	133 ^a (14.4)
	stem	6.3 ₂ (0.2)	0.63 ₁ (0.1)	1.0 ₁ (0.1)	3.0 ₂ (0.1)	36.3 ₂ (8.1)	35.0 ₁ (7.0)
Pella	leaf	6.0 ^a (1.9)	0.83 ^a (0.1)	2.7 ^a (0.1)	5.7 ^b (1.9)	24.0 ^b (11.1)	78 ^b (11.0)
	stem	5.1 ₂ (1.0)	0.71 ₁ (0.2)	1.0 ₁ (0.2)	4.9 ₂ (0.6)	42.0 ₂ (15.1)	22.0 ₁ (12.2)

Column for leaves (a,b) and stems (1,2) means with common superscripts do not differ significantly ($P > 0.05$)

The Ca, P and Mg concentrations of *B. foetida* were generally higher in leaves than in stems. Although the Ca concentrations were lower than those reported for *B. albitrunca* (11.1 - 14.4 g/kg) by Groenewald *et al.* (1967), Ca and Mg concentrations of *B. foetida* foliage were still higher than growth requirements of goats (Underwood, 1981; AFRC, 1998). The P concentrations were, however, too low (AFRC, 1998).

Boscia foetida leaves contained sufficient Cu concentrations at Marken for maintenance requirements of goats, but not at Klein Pella and Kenhardt (AFRC, 1998). The Mn concentrations at all sites were sufficient to meet maintenance requirements, but not that of Zn (AFRC, 1998).

Conclusion

The plant leaves had an acceptable level of digestibility. Although reported by numerous authors to be palatable (Palgrave, 1981; Le Riche & Van der Walt, 1999) it is unlikely that it would be the sole source of

browse for goats, since there are a number of other sources, such as *Acacia* spp., *Ehretia rigida* and *Ziziphus mucronata* in the areas where *Boscia* spp. normally grow.

Boscia foetida contains sufficient concentrations of Ca, Mg and Mn for the requirements of goats but lacks in P, Cu and Zn. The wide Ca:P ratio may present a problem, but ruminants can tolerate a relatively wide Ca:P ratio in the diet, provided that the P intake is high (Underwood, 1981).

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