**Selection preferences of Boer Goats in the Thornveld of the**

**Southern Limpopo, South Africa**

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**Abstract**

The selection behavior of Boer Goats was studied over a two year period in the Sourish Mixed Bushveld of the Limpopo Province, South Africa. Goats were followed and species browsed, selection frequency, plant parts selected and browsing height recorded. A selection index, based on species occurrence and frequency of selection was calculated for each species. *Ehretia rigida* and *Ziziphus mucronata*, *Panicum maximum* and *Eragrostis barbinodis* and *Lippia javanica* were the favoured tree, grass and forb species, respectively. Goats selected mainly browse leaf below 1.5 m during the growing season, while, in the dormant season, grass was increasingly selected due to the absence of browse. It was concluded that winter and early spring could pose a problem regarding grazing competition, should goats and cattle be kept in combination in a vegetation type of this nature.

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**Keywords:** Boer goats, browsing height, selection frequency, plant species preferences

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**Introduction**

The bush encroachment problem (Smit, 1994) and results obtained on the biological control of invasive species in the Eastern Cape by Trollope (1984) led to renewed interest in the use of the Boer Goat as bush utilizer and controller of bush encroachment in the Limpopo Province Bushveld. However, whereas veld management as­pects relating to Boer Goats was well documented in the Eastern Cape (Du Toit, 1972; Aucamp, 1976; Aucamp, 1979), boer goat research in Limpopo is limited a single study (Donaldson, 1979).

The bushveld of the Limpopo Province is mainly regarded as a game and cattle farming area. The introduction of Boer Goats immediately posed questions relating to plant species selection, goat/cattle competition and the determination of browsing capacity. Since research on the feeding preferences of Boer Goats has been done in other savannahs (Donaldson, 1979; Trollope, 1981a; Cooper, 1982; Stuart-Hill, 1987; Teague, 1989; Haschick & Kerley, 1997; Rothauge *et al*., 2003; Du Plessis *et al*., 2004 and Nyamukanza & Scogings, 2008), the aim of this study was to identify preferred bush, grass and forb species of Boer Goats in the Sourish Mixed Bushveld of the Limpopo Province.

**Methodology**

The study was conducted at the Towoomba Agricultural Devel­opment Centre (ADC), situated near Bela Bela, South Africa (28°21 'E, 24°25'S; 1 184m above sea level) during March 1991 to February 1993. The long-term annual rainfall is 630 mm per annum. The rainy season usually extends from October to March, but rainfall distribu­tion is erratic and unpredictable. The long-term daily average maximum and minimum temperatures vary between 30.2°C and l7.6°C for December and 21.0°C and 3.0°C for July respectively. The vegetation type is classified as Sourish Mixed Bushveld (Acocks, 1988). The woody layer of the plant community is dominated by *Dichrostachys cinerea* and *Acacia* species (81% of the total species composition). Broadleaved species such as *Ehretia rigida, Ziziphus mucronata, Grewia* and *Searsia* occured in low numbers. The tree density of the experimental site was 2530 trees ha-1 of which 39%, 27%, 18%, 6%, and 8% occurred in the 0.0-0.5m, 0.6-1.0m, 1.1-1.5m, 1.6-2.0m and >2.0m height classes, respectively. The grass layer is dominated by *Eragrostis* species (*E. barbinodis* and *E. rigidior*)*, Panicum maximum*, *Themeda triandra* and *Heteropogon contortus*.The soil is of the Hutton form (Soil Classification Working Group, 1991).

A direct observation technique (Du Plessis *et al*., 2004) was used in this study to observe the foraging behaviour of Boer Goats. To ensure that goats had enough material available to execute free choice of selection, observations were made in twelve ungrazed and unbrowzed camps, each approximately 4 ha in size. Due to predator problems, small stock are penned at night, taken out to veld at approxi­mately 08:00 and returned to the pens at approximately 15:30. Twelve mature goats of the flock were used during each observation period. Observations were made by following different goats for a period of two hours during the morning (09:00 to 11:00) and one hour during the afternoon (14:00 to 15:00) on the second day after goats was allowed into a camp. Individual goats were followed for 15 minutes during which selection data was recorded. Thereafter another goat was chosen and followed. Observations were made monthly on one day only. The following selection data were recorded: the tree, grass and forb species that were browsed, the frequency of selection (the number of times selected) of each species, as well as the frequency of selection of different plant parts. Browsing height was determined by recording the frequency of selection in different vegetation strata (ground level, 0.1 - ­0.5m, 0.6 - 1.0 m, 1.1 - 1.5m, 1.6 - 2.0m and >2.0m). Differences in the frequency of selection between legu­minous and non-leguminous tree species, as well as differences in the frequency of selection of different vegetation types (trees, grasses and forbs) during mornings and afternoons were also recorded. Tree, grass and forb density were also determined for each camp. Tree density was determined in two ran­domly placed, 100m x 2m strip transects, and grass and forb density in 30 randomly placed 1m x 1m quadrates per camp prior to selection observations. While conducting the study, situations occurred where plants occurred in low numbers, but were defoliated repeatedly. In other instances plants occurred in high numbers but were defoliated at low frequencies. To accommodate over- or underestimations of species preferences (Lüdemann, 1999; Du Plessis *et al*., 2004) a selection index was calculated for each tree, grass and forb species for each month, using the following formula:

Selection Index = Number of times selected x100

Number of times present

Where a plant species that was not encountered during the botanical survey was selected, it was assumed that the particu­lar species occurred at a density of one individual /hafor the particular observation period.

Plant species were grouped into preference classes (classes A, B, C, D and E which indicated highly preferred, pre­ferred, less preferred and least preferred plant species, respectively) by subjecting selection indices to cluster analysis (clustering by average; Statgraphics, 1991). The results are presented in Table 1. Selection frequency data of different vegetation types was subjected to correlation analysis. The overlap in plant-form (grass, forbs, woody) selection and differences in utilization height were analyzed, using Wilcoxon’s Signed Rank Test (Steel &Torrie, 1966).

**Results and discussion**

Figure 1 indicates that goats can mainly be regarded as browsers. Selection of all components (woody, grass and forb species) were negatively correlated (*p*< 0.001; r = -0.916, 0.054 and 0.335 for woody vs. grass, woody vs. forb and grass vs. forb species, respectively). While selection was mainly for browse during the growing season, grasses were increasingly selected during autumn to early summer (June to November) due to the absence of browse. Forbs se­lection increased during December and January due to annual forbs emerging during early summer. On a single occasion in September 1991, goats selected bird droppings (“Others” in Figure 1), presumably in an attempt to increase protein intake. On average, the ratio of trees:grass:forbs selected, based on the percentage frequency of selection, was 68:24:8 (or 8:3:1) over the two year trial period. This ratio was 73:16:11 (or 7:1.5: 1) during the growing sea­son (December to June) and 63:34:3 (or 21:11:1) during the dormant season (July to November).

Out of a total of 42 tree, 75 grass and 160 forb species that have been recorded at the Towoomba ADC, 26 tree, 26 grass and 30 forb species were selected by the goats. Broad-leaved (non-leguminous) species were favoured. Only 19% of the species at the experimental site consisted of non-leguminous species, but non-leguminous species were selected 72% of the time.

Highly preferred, preferred and less preferred classes of the bush component consisted of only one species each, namely *Ehretia rigida* and *Ziziphus mucronata* and *Acacia robusta*, respectively (Table 1). All other bush species were classed as least preferred species. Where the grass component was concerned, *Panicum maxi­mum and Eragrostis barbinodis* were classed as highly preferred, with *Cymbopogon pospischilii* less preferred. All other grass species were classed as least preferred. *Lippia javanica* (highly preferred), and *Protasparagus setaceus, Tagetes minuta* and *Pentarrhinum insipidum* (preferred) were shrub and forb species that were favoured.

**Table 1** Selection indices and preference classification for different tree, grass and forb species selected by Boer Goats in the Sourish Mixed Bushveld

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Tree species | Selection index | Preference class | Grass species | Selection index | Preference class | Forb species | Selection index | Preference class |
| *Acacia caffra* | 12.05 | D | *Aristida spp.* (grouped) | 2.00 | D | *Abutilon austro-africanum* | 0.42 | D |
| *Acacia gerrardii* | 3.18 | D | *Bothriochloa insculpta* | 5.21 | D | *Aloe daveyana* | 0.17 | D |
| *Acacia karroo* | 13.57 | D | *Bothriochloa radicans* | 0.13 | D | *Bidens pilosa* | 0.04 | D |
| *Acacia mellifera* | 1.67 | D | *Brachiaria nigropedata* | 0.63 | D | *Bonatea speciosa* | 0.08 | D |
| *Acacia robusta* | 51.93 | C | *Cenchrus ciliaris* | 10.58 | D | *Brayuleana dense* | 0.58 | D |
| *Acacia tortillis* | 11.07 | D | *Chloris virgata* | 4.00 | D | *Bulbostylis hispidula* | 0.08 | D |
| *Boscia albitrunca* | 0.09 | D | *Cymbopogon pospischilii* | 73.21 | C | *Chenopodium album* | 0.79 | D |
| *Carissa bispinosa* | 1.42 | D | *Cynodon dactylon* | 12.17 | D | *Commelina africana* | 12.83 | C |
| *Combretum hereroensis* | 3.71 | D | *Digitaria eriantha* | 31.21 | D | *Crotalaria absus* | 0.13 | D |
| *Combretum molle* | 0.08 | D | *Elyonurus muticus* | 1.71 | D | *Cyphostemma puberulum* | 6.58 | D |
| *Dichrostachys cinerea* | 1.48 | D | *Enneapogon scoparius* | 2.71 | D | *Dipcadi spp.* | 1.29 | D |
| *Diospyros lycioides* | 14.05 | D | *Eragrostis barbinodis* | 128.58 | A | *Evolvulus alsinoides* | 0.54 | D |
| *Dombeya rotundifolia* | 1.08 | D | *Eragrostis biflora* | 1.08 | D | *Felicia muricata* | 10.42 | D |
| *Ehretia rigida* | 180.81 | A | *Eragrostis rigidior* | 0.17 | D | *Hermannia sp.* | 4.04 | D |
| *Euclea crispa* | 3.70 | D | *Eragrostis superb* | 0.21 | D | *Hibiscus trionum* | 0.13 | D |
| *Grewia flava* | 4.23 | D | *Heteropogon contortus* | 18.29 | D | *Indigofera spp.* (grouped) | 1.96 | D |
| *Grewia flavescens* | 1.26 | D | *Hyparrhenia hirta* | 2.63 | D | *Kalanchoe brachyloba* | 0.21 | D |
| *Gymnosporia buxifolia* | 30.88 | D | *Hyperthelia dissoluta* | 0.17 | D | *Lippia javanica* | 70.29 | A |
| *Pappea capensis* | 0.46 | D | *Melenis repens* | 0.04 | D | *Leonotis dysophylla* | 0.33 | D |
| *Peltophorum africanum* | 0.46 | D | *Panicum coloratum* | 1.00 | D | *Ocimum sp.* | 0.08 | D |
| *Schlerocarya birrea* | 1.54 | D | *Panicum maximum* | 109.28 | A | *Pentarrhinum insipidum* | 28.88 | B |
| *Searsia leptodictya* | 10.31 | D | *Schmidtia pappophoroides* | 18.50 | D | *Portulaca oleracea* | 1.04 | D |
| *Searsia lancea* | 5.88 | D | *Themeda triandra* | 73.21 | D | *Protasparagus setaceus* | 37.21 | B |
| *Searsia pyroides* | 10.07 | D | *Tragus racemosus* | 0.67 | D | *Schuria pinnata* | 7.08 | D |
| *Tarconanthus camphoratus* | 11.46 | D | *Tricholaena monachne* | 0.13 | D | *Solanum catombelense* | 8.38 | D |
| *Ziziphus mucronata* | 101.52 | B | *Urochloa mosambicensis* | 9.42 | D | *Tagetes minuta* | 36.08 | B |
|  |  |  |  |  |  | *Tapinanthus kraussianus* | 9.75 | D |
|  |  |  |  |  |  | *Thesium burkei* | 0.17 | D |
|  |  |  |  |  |  | *Veronia vastigata* | 0.38 | D |
|  |  |  |  |  |  | *Zinnia multiflora* | 4.00 | D |

Preference class A = Highly preferred

Preference class B = Preferred

Preference class C = Less preferred

Preference class D = Least preferred



**Figure 1** Selection frequency percentages of different vegetation components selected by Boer Goats in the Sourish Mixed Bushveld

The average selection frequency at different browsing heights was 14, 40 17, 23, 4 and 0.3% at ground level, 0.0 - 0.5m, 0.5 – 1.0m, 1.0 - 1.5m, 1.5 – 2.0m and *>*2m, respectively (Figure 2). The frequency of selection from ground level to a height of 1.5m amounted to an average 92% over the two seasons (z = 5.79, p<0.0001, n = 23). In single cases, mainly due to the selection of *Tapinanthus kraussianus,* browsing height exceeded 2.0m. This is in accordance with the findings of Trollope (1981b) and Du Plessis *et al*. (2004), who indicated that the brows­ing height of Boer Goats could be higher but rarely exceeded a height of 1.5m. Grass and forb selection height rarely exceeded 1.0m.

Goats selected leaf material of different vegetation types. Selection of other plant parts was negligible in comparison (Table 2). While leaves were selected off trees during the growing season, leaf intake during winter mainly consisted of litter of broad-leaved species such as Z. *mucronata, E. rigida* and *Gymnosporia buxifolia.* Seed pod consumption increased during the winter periods of both seasons, mainly due to increased selection of fallen *A. tortillis* and *D. cinerea* pods. Fruit selection was limited to single intakes of the fallen fruit of *Sclerocarya birrea* during February. Opportunistic selection of these components averaged less than 5% of the total frequency of selection over the two seasons. Increased shoot selection was observed during spring, where young shoot regrowth was utilized together with leaves.

Mainly grass leaves were selected, but increased selection of grass seeds (mainly *P. maximum* seeds) was ob­served during winter. Leaves were also the main source of selection in the herbaceous layer. Opportunistic selection of shoots *(Protasparagus setaceus* and *L. javanica)* and seeds or seed pods of mainly leguminous species *(Indigofera* and *Tephro­sia* species) averaged less than 1% of the total frequency of selection. Forb shoots, seeds and seed pods were minimally selected when available.



**Figure 2** Browsing heights of trees, grasses and forbs in the Sourish Mixed Bushveld by Boer Goats

**Table 2** Signed Rank Test matrix for different plant parts utilized by Boer Goats. Z-values are indicated (*p*<0.01, n=23, Critical value = 3.9)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Leaves | Branches | Fruits | Seeds |
| Trees: |  |  |  |  |
| Leaves | - | - | - | - |
| Branches | 5.68 | - | - | - |
| Fruits | 5.92 | 4.08 | - | - |
| Seeds | 5.68 | 1.61NS | -2.59 NS | - |
| Grasses: | - | - | - | - |
| Leaves | - | - | - | - |
| Seeds | 6.01 | - | - | - |
| Forbs |  |  |  |  |
| Leaves | - | - | - | - |
| Branches | 5.97 | - | - | - |
| Fruits | 6.25 | 2.27 NS | - | - |
| Seeds | 6.13 | 1.66 NS | -0.559 NS | - |
|  |  |  |  |  |

NS = Non-significant

Subjective observations during every observation period indicated vigorous browsing within the first half to one hour after animals were admitted to a camp. During this period bush was the main source of selection. Thereaf­ter browsing rate eased and bush, grass and forbs were utilized with bush still the main source of selection. Mid­day was usually spent resting around watering points. During the afternoon browsing rate declined. Selection during the afternoon tended to favour the grass component.

**Conclusions**

Results suggest that goats and cattle can both be kept on the same area, provided that enough browsing is available to minimize grazing competition. However, certain problems need to be addressed. The occurrence of only two tree species that are high on the preference order of Boer Goats in a veld type of this nature may pose problems in terms of over-utilization of key species. Precise browsing management is thus extremely important. Furthermore, di­rect competition between cattle and goats may be expected during winter and early spring. The latter is regarded as a critical period in Limpopo, during which a shortage of grazing material due to an unpredictable rainfall pattern is often encountered. The preference of goats for *P. maximum,* which is regarded as a highly preferred spe­cies for cattle (Jordaan, 1991), pose an even bigger problem. As one of only two highly pre­ferred grass species in the diet of goats, grazing competition could become important. Management practices and stock numbers should therefore be adapted to accommodate either lower cattle or goat numbers during this period (Donaldson, 1979). Herd numbers and herd sizes should subsequently change through the season in a management system where both browsing and grazing management systems are used separately for goats and cattle.

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