Rangeland utilization by beef cattle in the dry Savanna areas of Southern Africa

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SUMMARY

A literature review was done on the selection and utilization of grass species by beef cattle in the Limpopo province. The literature study was complimented by research done on the Towoomba Research station and the University of Limpopo, both in Limpopo Province, in South Africa. The Province is well known for its low rainfall and good quality rangeland. The main aim was to categorize the most important grass species in different utilization (palatability) classes. The thirteen grass species which were under investigation could be classified as follows: Highly palatable species: Panicum maximum and Urochloa mosambicensis; Palatable species: Digitaria eriantha, Heteropogon contortus, Schmidtia pappophoroides and Themeda triandra. Less palatable: Trachypogon spicatus and Themeda triandra and Least palatable: Eragrostis rigidior, Hyparrhenia hirta, Pogonarthria squarrosa, Melinus repens and the Aristida species.

Keywords: *palatability, grass species, Limpopo Province*

ÖSSZEFOGLALÁS

A munka áttekintést ad Dél-Afrikában, Limpopo tartományban a fűfajok hasznosításáról húsmarhák esetében. A tanulmány a Towoomba Research Station és a University of Limpopo által végzett kutatásokat mutatja be. A tartomány a csapadék szempontjából húsmarha tenyésztésre alkalmas. A fő cél az volt, hogy csoportosítani lehessen a legfontosabb fűfajokat hasznosítási szempontok szerint, különböző ízletességi csoportokba sorolva. A 13 fűfaj, amelyek a vizsgálat alapján következő csoportba sorolhatók be: kiemelten ízletes fajok: Panicum maximum és Urochloa mosambicensis, ízletes fajok: Digitaria eriantha, Heteropogon contortus, Schmidtia pappophoroides és Themeda triandra. kevésbé ízletes: Trachypogon spicatus és Themeda triandra és a legkevésbé ízletes: Eragrostis rigidior, Hyparrhenia hirta, Pogonarthria squarrosa, Melinus repens évelő és az Arista nemzetség egyéves fajai.

Kulcsszavak*: ízletesség, pázsitfüvek, Limpopo tartomány*

INTRODUCTION

Grasslands and rangelands are important for biodiversity conservation and for agriculture (Valkó et al., 2016). Grazing is the primary land use type in rangelands (Nagy et al., 2011; Tälle et al., 2016; Török et al., 2014, 2016; Nagy és Tasi, 2017). For effective rangeland management, biomass quality (Deák et al., 2011; Kelemen et al., 2013; Valkó et al., 2012; Penksza et al., 2010, 2013; Zimmermann et al., 2012), the effects of grazing animal type and grazing intensity (Halász és Jonas, 2014; Halász et al., 2016; Godó et al., 2017; Deák et al., 2018; Tóth et al., 2016; Szentes et al., 2009, 2011) and the grazing preferences of the animals should be carefully considered (Tasi, 2006; Kovácsné Koncz et al., 2015a, b). In the present paper, rangeland utilization by beef cattle and the palatability of the most important forage grasses are studied in South-African rangelands.

CLIMATIC CONDITIONS IN THE PROVINCE

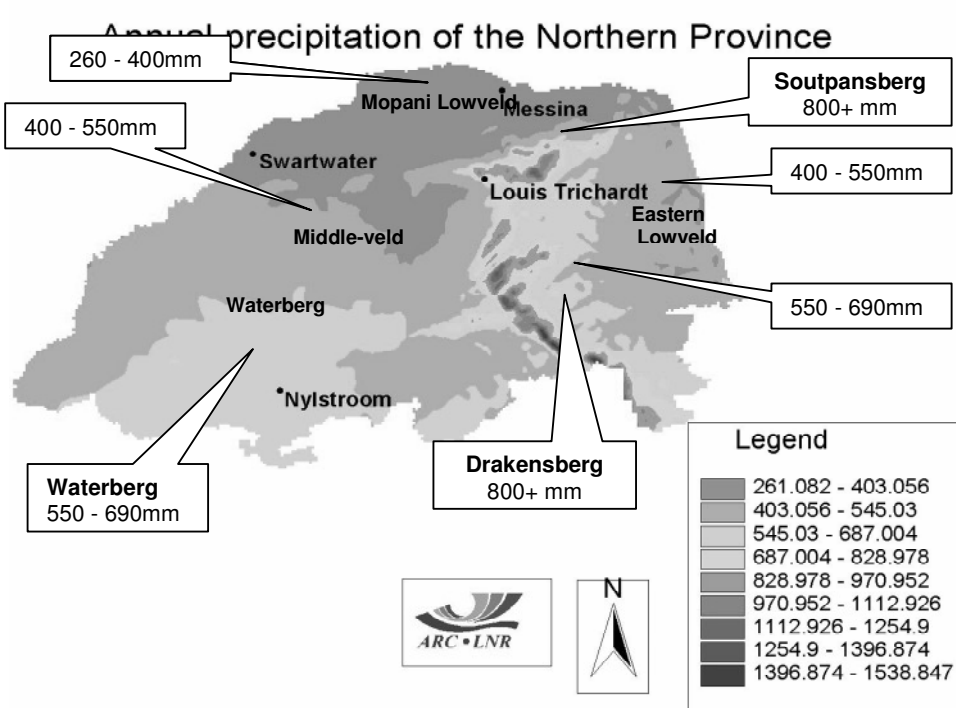
The Limpopo Province, one of the nine provinces of South Africa, is situated in the far northern part of South Africa. It shares borders with Botswana, Zimbabwe and Mozambique. The Province covers an area of 13.8 million ha, accounting for 10.2% of the country's total surface (Anon, 1996). There are three district mountainous areas in the Province (*Figure 1*) namely the Soutpansberg (in the north), the Drakensberg in a north/south direction and the Waterberg (south/west). These mountain ranges encountered for the highest rainfall areas in the Province (*Figure 1*).

North of the Soutpansberg is the Mopani Lowveld, which receives the lowest rainfall in the Province. The Eastern Lowveld is situated on the far eastern part of the Province with a low to medium rainfall. The rest of the Province is so called Middle-veld (western and central part), with an annual rainfall of 400 to 550 mm. The Lowveld region is hot and dry with no frost and an average rainfall of less than 550 mm per year; in the mountainous areas it is cool and wet with a rainfall that varies from 800 to 1000 mm per year. The central parts are warm, with very warm conditions towards the west, while the Mopani Lowveld (North) can be extremely hot.

LIVESTOCK PRODUCTION

The Province is well known for its beef cattle and game production. *Table 1* indicates that the Province is situated in the summer rainfall region of South Africa. The consequence is that livestock has to be fed for twelve months of the year, with feed produced only from mid-October to mid-March. This is because of no rainfall in winter and a lack of irrigation water. It is thus important to conserve fodder for the period March to June and to take special care to have enough forage material for the period July to October. For this purpose the summer growing tropical grasses (growing in the natural rangeland) have to be rested in summer, to be utilized in a dormant stage in winter.

Figure 1: **Rainfall distribution in the Limpopo Province (ARC, South Africa)**



1. ábra: A csapadék eloszlása Limpopo tartományban (ARC, Dél-Afrika)

Table 1

Seasonal distribution of rainfall in the Limpopo Province

SUMMER					AUTUMN		WINTER			SPRING	
NOV	DEC	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEPT	OCT
RAIN					NO RAIN						RAIN
Active grass growth					Grasses dormant, medium to good quality						Slow grow

1. táblázat: Szezonális csapadék eloszlása Limpopo tartományban

GRASS SPECIES DIVERSITY

South Africa is divided into six main vegetation zones (Biomes). The Limpopo Province is situated in the Savanna biome, which is characterized by a balanced combination of trees, shrubs and grass. Beef cattle are mainly grazers and for that reason special attention is given to the grass component. Many game species utilize grass species, but a large number of them browse tree leaves and twigs. An estimated 200+ grass species occur in the Province, however attention is given to the most important indicator grass species in the area. The ecological status and grazing value of these grass species are shown in *Table 2* (Jordaan and Robinson, 1999).

The Indicator[1] status of the different species is:

- Decreaser: These are species that occur in rangeland which is in good condition and which will decline in numbers when over- or under utilized.
- Increaser I species do not occur in rangeland which is in good condition. These species will replace the decreaser species when rangeland is under utilized or when fire is excluded.
- Increaser II species do not occur in rangeland which is in good condition. These species will replace will decreaser species where rangeland is overgrazed and/or regularly burnt.

The Grazing value ([2] in *Table 2*) of grass species is a product of the interaction between yield and acceptability (palatability) of the species (Bajnok et al., 2010; Tasi et al., 2013). It is measured on a scale of 0 to 10. A species with a value of 0 has a low yield and it is unpalatable and a species with a 10 value is a high producer and is highly palatable. The values in brackets in this column (*Table 2*) are average values.

The decreasers could be classified as the more palatable species, while the increasers are indications of previously poor managed rangeland. Some of these species differ from area to area and are called different ecotypes. Examples are *Themeda triandra* and *Digitaria eriantha* of which ecotypes are more desirable and palatable in the cooler, high rainfall areas then in the warm, dry areas. The opposite is true for *Heteropogon contortus.* This explains why some species have different grazing values in *Table 2* (*Themeda triandra* with 5 to 10).

Table 2

The ecological status and grazing value of the grass species in the study

Species	Abbreviation	Indicator[1]	Grazing value[2]
Panicum maximum	Pan.max	Decreaser	10
Themeda triandra	Them.tri	Decreaser	5-10 (7)
Brachiaria nigropedata	Brach.nig	Decreaser	8
Digitaria eriantha	Dig.er	Increaser I	3-5 (4)
Trachypogon spicatus	Trch.spic	Increaser I	2
Cymbopogon plurinodus	Cym.plur	Increaser II	0-1
Schmidtia pappophoroides	Schm.pap	Increaser II	3-5 (4)
Eragrostis rigidior	Erag.rig	Increaser II	0-1
Cynodon dactylon	Cyn.dac	Increaser II	2-3 (3)
Heteropogon contortus	Het.cont	Increaser II	2-6 (5)
Pogonarthria squarrosa	Pog.squa	Increaser II	0
Melinus repens	Mel	Increaser II	0-1(1)
Aristida spp.	Aris	Increaser II	0-1

2. táblázat: A legelt pázsitfüvek ökológiai érzékenysége és gyepgazdálkodási értékei

NUTRITIONAL VALUE OF GRASS SPECIES

Because of the lack of rainfall in winter (as shown earlier), on each farm some rangeland should not be grazed in summer so that forage material could accumulate for winter utilization. This can only be done with grass species that keep its palatability in a matured stage (in winter). According to Shaker (2009), one fairly effective method of evaluating the quality of forage species is by using the dry matter digestibility (DMD), acid detergent fibre (ADF), neutral detergent fibre (NDF) and crude protein (CP) content of the plant material. These values of ten of the Limpopo grass species are given in *Table 3*.

Table 3 indicates that most grasses with a grazing value of 4 and higher (in brackets, column 1) showed CP values of above 10% and relative low ADF and NDF values, even in the late vegetative stage. The grasses with low grazing values (1) showed higher ADF (46+ %), NDF (70+ %) and DMD (60+ %) values and low CP (-8%) values. It is further a well known fact that the nutritional value of tropical grasses is lower than that of temperate grasses (specifically in a matured stage).

Table 3

The change in ADF, NDF and CP during the growing season (Shaker, 2009)

	Early vegetation				Late vegetation			
Species (grazing value)	**ADF**	**NDF**	**CP**	**DMD**	**ADF**	**NDF**	**CP**	**DMD**
Panicum maximum (10)	39.5	67.8	9.9	59.7	35.2	69.1	10.3	42.4
Urochloa mosambicensis (8)	41.5	72.1	14.5	-	39.8	71.1	15.1	-
Heteropogon contortus (5)	43.9	72.0	8.6	53.3	48.3	76.3	7.2	45.8
Digitaria eriantha (4)	38.3	62.7	10.4	65.9	47.4	70.2	10.4	60.0
Schmidtia pappophoroides (4)	36.3	67.4	13.7	58.4	38.2	70.2	8.2	44.5
Cynodon dactylon (3)	39.2	70.2	10.4	-	50.3	72.7	11.3	-
Cymbopogon plurinodus (1)	49.8	70.9	3.6	-	46.3	65.2	5.3	-
Eragrostis rigidior (1)	43.1	75.0	8.4	48.0	46.8	76.2	7.9	32.5
Melinus repens (1)	47.3	73.7	7.3	-	47.1	74.2	7.5	-
Aristida spp (1)	44.2	76.4	6.1	-	47.2	79.5	5.5	-

3. táblázat: Az ízletességi változások a növekedési időszakokban (Shaker, 2009)

GRAZING PATTERN AND SPECIES SELECTION BY BEEF CATTLE IN THE LIMPOPO PROVINCE

Research was done on the Towoomba Research Station (Bela Bela district, Limpopo Province) to catagorized grass species in palatability classes (Jordaan, 1995). This was done to identify those grass species that can play an important role in winter grazing. The results of this study are summarized in *Table 4*.

A similar experiment was done on the University of Limpopo experimental farm (Syferkuil) in the Mankweng district in the Limpopo Province.

A continuous grazing systems with a realistic stocking rate (10 ha/LSU/year) was applied (1 LSU is equal to an animal of 450 kg and gaining at least 500 g per day). During the winter and spring of 2001 surveys were done to establish the preference rate of different individual grass species by beef cattle. Grass tufts were classified into three utilization classes after grazing: Individual tufts that were not grazed (0%), tufts that were grazed leniently (33% of the total above ground material removed) and tufts that were grazed heavily (66% of the total above ground material removed).

Table 4

A comparison between palatability classes in the two studies on Towoomba and Syferkuil

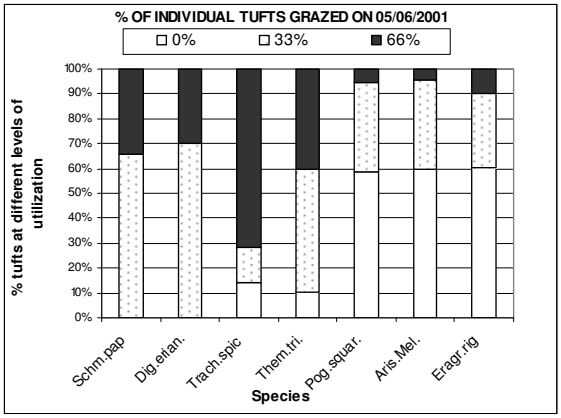
Highly palatable		**Palatable**	
Towoomba	**Syferkuil**	**Towoomba**	**Syferkuil**
B. nigropedata	N/A	*D. eriantha*	*D. eriantha*
C. dactylon	N/A	*H. contortus*	N/A
P. maximum	N/A	*S. pappophoroides*	*S. pappophoroides*
U. mosambicensis	N/A	*M. repens*	
		T. triandra	
Less palatable		**Least palatable**	
Towoomba	**Syferkuil**	**Towoomba**	**Syferkuil**
C. plurinodis	N/A	*Aristida* species	*Aristida* species
	T. spicatus	*E. rigidior*	*E.rigidior*
	*T. triandra**	*H. hirta*	N/A
		P. squarrosa	*P. squarrosa*
			M. repens **

4. táblázat: A fűfajok ízletességi összehasonlítása a Towoomba és a Syferkuil Kutató Állomáson

Results in *Figure 2* indicated that all tufts of *Schmidtia pappohoroides* and *Digitaria eriantha* present in the camps were grazed, during winter. Respectively 33% and 30% of the tufts of these two species were grazed leniently (33% material removed), while 67% and 70% of the tufts were utilized heavily (66% material removed). Between 10% and 14% of *Trachypogon spicatus* and *Themeda triandra* tufts (respectively) were not grazed at all. About 15% of *Trachypogon spicatus* tufts were grazed leniently (33% material removed), 72% were grazed heavily and the rest were not grazed. Leniently grazed *Themeda triandra* tufts were 49%, while 40% were grazed heavily and the rest were not grazed. Sixty percent of *Pogonarthria squarrosa, Aristida* spp. *Melinus repens* and *Eragrostis rigidior* tufts were not grazed, between 30 and 35% of tufts were grazed leniently and less than 10% were grazed heavily.

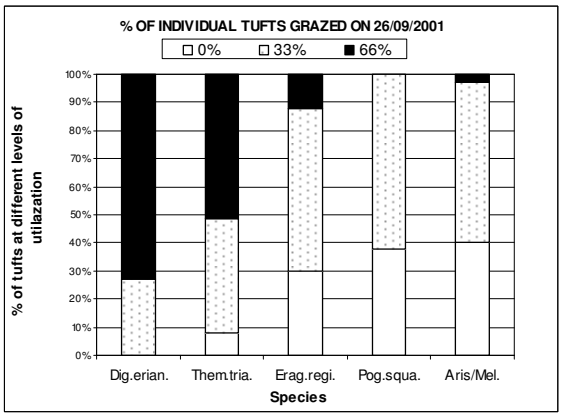
During spring (*Figure 3*) 72% of *Digitaria eriantha* tufts were grazed heavily and the rest of the tufts leniently. This was followed by *Themeda triandra* with 51% of the tufts grazed heavily, 41% grazed leniently and 8% were not grazed. Species less preferred in spring were *Pogonarthria squarosa, Melinus repens, Aristida* spp. and *Eragrostis rigidior.*

Figure 2: **Preference rate of grass species during winter, according to percentage utilization of tufts**



2. ábra: A fűfajok preferenciája a zsombékok arányában a téli időszakban

Figure 3: **Preference rate of grass species during spring, according to percentage utilization of tufts**



3. ábra: A fűfajok preferenciája a zsombékok arányában a tavaszi időszakban

The results from the Towoomba Research Station (Jordaan, 1995) and those obtained on the University of Limpopo experimental farm (Syferkuil) are compared in *Table 5*.

Species marked N/A were not present at the University of Limpopo experimental farm. According to *Table 5* five of the eight species on the University of Limpopo experimental farm were classified the same as suggested by Jordaan (1995). They were: *D. eriantha, S. pappophoroides, E. rigidior, P. squarrosa* and the *Aristida* species. *Melinis repens*** was classified by Jordaan (1995) as palatable, which is correct in an early vegetative stage. The observations on the University of Limpopo experimental farm were done in winter and spring, when grasses were in a matured stage, when these species tend to be less palatable. The same argument could be used for *Themeda triandra**, although the existence of different ecotypes was mentioned earlier, which also might influenced the results.

Table 5

Palatability of grass species on the Towoomba Research Station

Highly palatable	**Palatable**
Brachiaria nigropedata	*Digitaria eriantha*
Cynodon dactylon	*Heteropogon contortus*
Panicum maximum	*Schmidtia pappophoroides*
Urochloa mosambicensis	*Melinus repens*
	Themeda triandra
Less palatable	**Least palatable**
Cymbopogon plurinodis	*Aristida* spesies
	Eragrostis rigidior
	Hyparrhenia hirta
	Pogonarthria squarrosa

5. táblázat: Ízletes pázsitfüvek a Towoomba Kutató Állomáson

CONCLUSIONS

According to the two studies the 13 grass species which were under investigation could be classified as follows:

Highly palatable: *Panicum maximum* and *Urochloa mosambicensis*

Palatable: *Digitaria eriantha, Heteropogon contortus, Schmidtia pappophoroides* and *Themeda triandra*

Less palatable: *Trachypogon spicatus* and *Themeda triandra.*

Least palatable**:** *Eragrostis rigidior, Hyparrhenia hirta, Pogonarthria squarrosa, Melinus repens* and the *Aristida* species

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