

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 (palatable) 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*, *Melinis repens* and the *Aristida* species.

Keywords: rangeland, grass species, palatability

ÖSSZEFOGLALÁS

Ez az irodalmi forrásokra alapozott tanulmány a fűfajokra vonatkozóan vizsgálja a húsmarhák válogatását és fűfogyasztását. Dél-Afrika Limpopo tartományára tekintettel. Azoknak a vizsgálatoknak az eredményeit tekintik át, amelyeket két helyszínen a Towoomba kutató állomáson és a Limpopo Egyetemen végeztek. A két vizsgálati helyszínen Limpopo tartományban található, ami jól ismert a kis mennyiségű éves csapadékról és a jó minőségű természetes (szavanna) gyepeiről. A kutatások célja az volt, hogy a legfontosabb fűféléket különböző hasznosítási (ízletességi) kategóriákba sorolják. 14 fajt vizsgáltak, amelyeket végül a következő csoportokba soroltak: nagyon ízletes fajok (*Panicum maximum*, *Urochloa mosambicensis*, *Digitaria eriantha*, *Heteropogon contortus*, *Schmidtia pappophoroides*, *Themeda triandra*), kevésbé ízletes fajok (*Trachypogon spicatus*, *Themeda triandra*), a legkevésbé ízletesek (*Eragrostis rigidior*, *Hyparrhenia hirta*, *Pogonarthria squarrosa*, *Melinis repens*, *Aristida* species).

Kulcsszavak: extenzív gyepek, fűfajok, ízletesség

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 Middleveld (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.

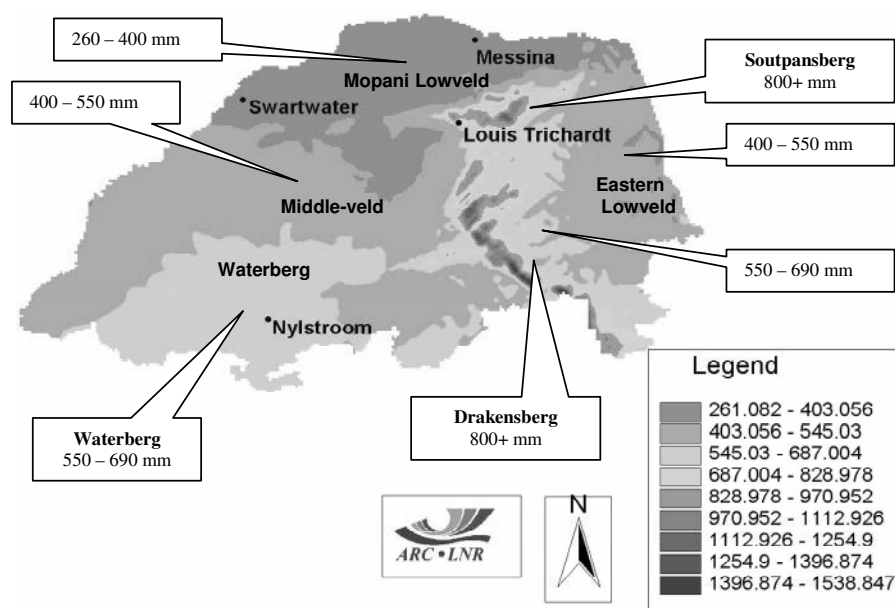
LIVESTOCK PRODUCTION

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.

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).

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



1. ábra: Csapadék eloszlás Limpopo tartományban (ARC, Dél-Afrika)

Table 1

Seasonal distribution of rainfall and grass growth in the Limpopo Province

SUMMER(1)					AUTUMN(2)		WINTER(3)			SPRING(4)		
NOV	DEC	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEPT	OCT	
RAIN(5)					NO RAIN(6)							RAIN(5)
Active grass growth(7)					Grasses dormant, medium to good quality(8)							Slow Growth(9)

1. táblázat: A csapadék és a fűnövekedés szezonális eloszlása Limpopo tartományban
nyár(1), ősz(2), tél(3), tavasz(4), csapadék(5), nincs csapadék(6), aktív fű növekedés(7), a fűvek nyugalomban, minőségük átlagos vagy jó(8), hosszú fű növekedés(9)

Table 2

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

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

2. táblázat: A vizsgálatba vont fűvek ökológiai státusza és „visszaszoruló növények” legelői értéke
fajok(1), a név rövidítése(2), ökológiai csoport(3), legelői érték(4), értékes fajok a gyepekben, amelyek jó állapotban vannak, a fajok visszaszorulnak, amint a gyeget alul- vagy túllegeltetik(5), „előre törő I” növények; Ezek a fajok a jó állapotban lévő természetes gyepekben nem fordulnak elő. Akkor veszik át a „visszaszoruló növények” helyét, ha a természetes gyeget alulhasznosítják, vagy az égetést, mint gyepekkezelő eljárást nem használják(6), „előre törő II” növények, melyek a jó állapotú gyepekben nem fordulnak elő; Akkor veszik át a „visszaszoruló növények” helyét, ha túllegeltetik a gyeget, vagy rendszeresen felégetik(7)

The Indicator¹ 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. 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 decreaseers could be classified as the more palatable species, while the increaseers 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 explain why some species has different grazing values in Table 2 (*Themeda triandra* with 5 to10).

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 been 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)

Species (grazing value)(3)	Early vegetation(1)				Late vegetation(2)			
	ADF(4)	NDF(5)	CP(6)	DMD(7)	ADF(4)	NDF(5)	CP(6)	DMD(7)
<i>Panicum maximum</i> (10)	39.5	67.8	9.9	59.7	35.2	69.1	10.3	42.4
<i>Urochloa mosambicensis</i> (8)	41.5	72.1	14.5	-	39.8	71.1	15.1	-
<i>Heteropogon contortus</i> (5)	43.9	72.0	8.6	53.3	48.3	76.3	7.2	45.8
<i>Digitaria eriantha</i> (4)	38.3	62.7	10.4	65.9	47.4	70.2	10.4	60.0
<i>Schmidtia pappophoroides</i> (4)	36.3	67.4	13.7	58.4	38.2	70.2	8.2	44.5
<i>Cynodon dactylon</i> (3)	39.2	70.2	10.4	-	50.3	72.7	11.3	-
<i>Cymbopogon plurinodus</i> (1)	49.8	70.9	3.6	-	46.3	65.2	5.3	-
<i>Eragrostis rigidior</i> (1)	43.1	75.0	8.4	48.0	46.8	76.2	7.9	32.5
<i>Melinis repens</i> (1)	47.3	73.7	7.3	-	47.1	74.2	7.5	-
<i>Aristida spp</i> (1)	44.2	76.4	6.1	-	47.2	79.5	5.5	-

3. táblázat: Az ADF, NDF és nyersfehérje-tartalom változása a növekedési időszak során korai vegetációs időszak(1), késői vegetációs időszak(2), fajok (zárójelben a legelői érték)(3), sav detergens rost(4), neutrális detergens rost(5), nyersfehérje(6), szárazanyag emészthetőség(7)

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 categorize 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).

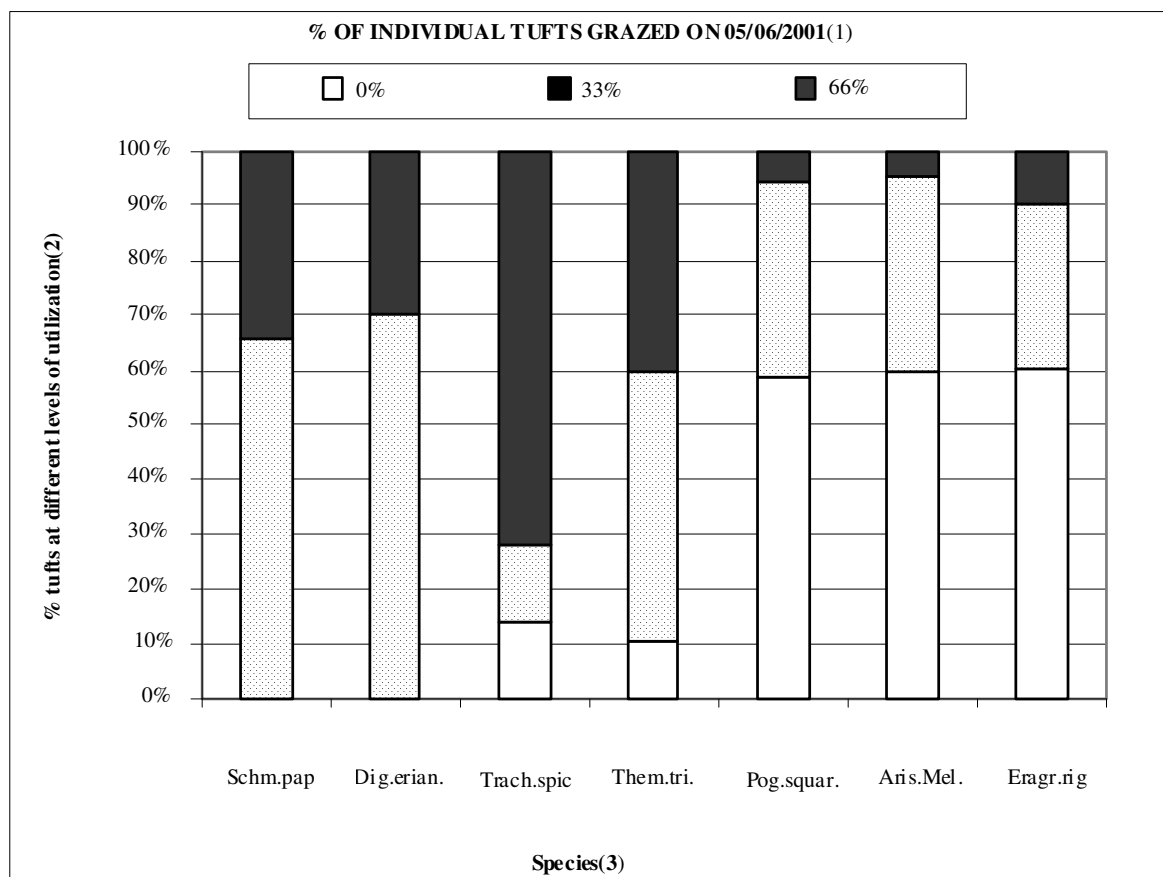
Table 4
Palatability of grass species on the Towoomba Research Station

Highly palatable(1)	Palatable(2)
<i>Brachiaria nigropedata</i>	<i>Digitaria eriantha</i>
<i>Cynodon dactylon</i>	<i>Heteropogon contortus</i>
<i>Panicum maximum</i>	<i>Schmidtia pappophoroides</i>
<i>Urochloa mosambicensis</i>	<i>Melinus repens</i>
	<i>Themeda triandra</i>
Less palatable(3)	Least palatable(4)
<i>Cymbopogon plurinodis</i>	<i>Aristida species</i>
	<i>Eragrostis rigidior</i>
	<i>Hyparrhenia hirta</i>
	<i>Pogonarthria squarrosa</i>

4. táblázat: A fajok ízletességének eredményei a Towoomba Kutató Állomáson nagyon ízletes(1), ízletes(2), kevésbé ízletes(3), a legkevésbé ízletes(4)

Results in Figure 2 indicated that all tufts of *Schmidtia pappophoroides* 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.

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

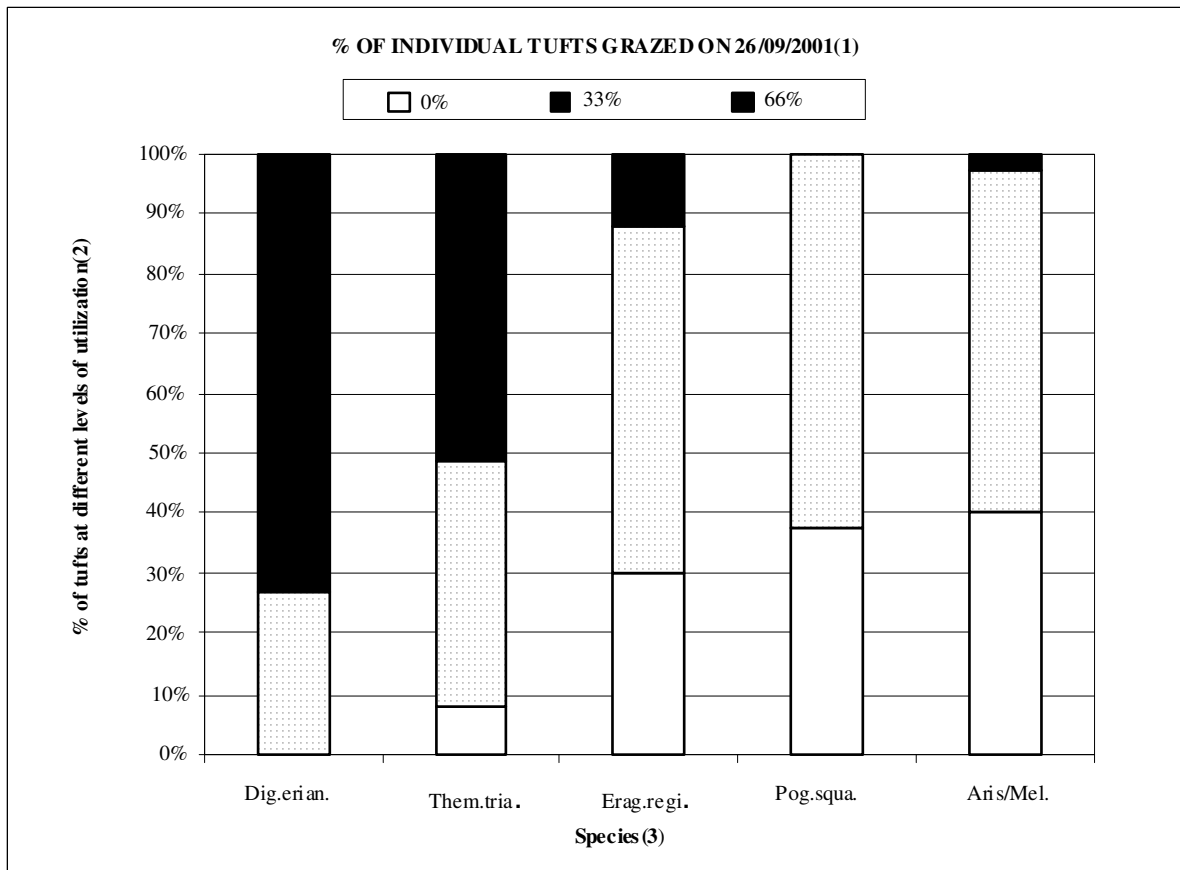


2. ábra: A gyepalkotó növények fogyasztásának mértéke a téli időszakban a hajtások lelegelés aránya szerint a hajtások lelegelésének mértéke 2001. 06. 05-én %-ban(1), a hajtások hasznosításának aránya a lelegelés mértéke szerint(2), fajok(3)

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 squarrosa*, *Melinus repens*, *Aristida* spp. and *Eragrostis rigidior*.

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



3. ábra: A gyepalkotó növények fogyasztásának mértéke tavaszi időszakban a hajtások letelelésének mértéke 2001. 09. 26-án %-ban(1), a hajtások hasznosításának aránya a letelelés mértéke szerint(2), fajok(3)

The results from the Towoomba Research Station of Limpopo experimental farm (Syferkuil) are compared in Table 4.

Table 4

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

Highly palatable(1)		Palatable(2)	
Towoomba	Syferkuil	Towoomba	Syferkuil
<i>B. nigropedata</i>	N/A	<i>D. eriantha</i>	<i>D. eriantha</i>
<i>C.dactylon</i>	N/A	<i>H.contortus</i>	N/A
<i>P. maximum</i>	N/A	<i>S. pappophoroides</i>	<i>S. pappophoroides</i>
<i>U.mosambicensis</i>	N/A	<i>M. repens</i>	
		<i>T. triandra</i>	
Less palatable(3)		Least palatable(4)	
Towoomba	Syferkuil	Towoomba	Syferkuil
<i>C. plurinodis</i>	N/A	<i>Aristida spesies</i>	<i>Aristida spesies</i>
	<i>T. spicatus</i>	<i>E. rigidior</i>	<i>E. rigidior</i>
	<i>T. triandra*</i>	<i>H. hirta</i>	N/A
		<i>P. squarrosa</i>	<i>P. squarrosa</i>
			<i>M. repens**</i>

4. táblázat: A vizsgált növények ízletességi csoportosításának összehasonlítása a két vizsgálat eredményei alapján (Towoomba, Syferkuil) nagyon ízletes(1), ízletes(2), kevésbé ízletes(3), a legkevésbé ízletes(4)

Species marked N/A were not present at the University of Limpopo experimental farm. According to Table 4 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.

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*, *Melinis repens* and the *Aristida* species

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