Assessment of grass species composition and nutritive value as influenced by soil characteristics in two different grazing areas under North West Province South Africa.

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INTRODUCTION

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- Grass species is considered as the main plant type for forage that plays an important role in livestock feeding for both arid and semi-arid regions (Rust & Rust, 2013).
- fluctuations in quality and quantity of grass forages can be due to:
  - erratic rainfall patterns.
  - seasonal changes
- On such cases, resource-poor farmers depend on crop residues and poor quality pastures as major sources of feed.
  - Low quality grasses have high lignin and low protein content.

INTRODUCTION

- This is because commercial feedstuffs are very expensive to resource-poor farmers.
- Alternatively, grasses can be used as means for rumen fill for livestock.
- Grass biomass is greatly affected by biotic and abiotic factors.
- Biotic: herbivory and farmers cultural practices
- Abiotic: environmental and climatic factors.
- Unreliable rainfall in semi-arid areas threatens grazing lands from recovering after grazing and lead to lower productivity on livestock (Tainton, 1981).

RESEARCH PROBLEM

- Quantity and quality of the grass are some of the most important factors in maximizing the amount of nutrients required by livestock.
- Unidentified different grass species and their nutritional composition are some of the problems faced by many farmers.
- Understanding of grass species, high intake of quality feeds and the biomass are the main worry in ruminant livestock producers.

- This creates a challenge, especially when farmers needed to introduce supplementation for optimum production of their livestock (Tainton, 1999).

JUSTIFICATION

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- Grass species distribution depend on the environment factors

- Problems faced by livestock in many areas are nutrients deficiencies caused by incorrect supplementation and insufficiencies due to unidentified and unanalysed grass species and the lack of understanding the biomass production of each grass species.

- Better understanding of the biomass and nutritional value of resources available to grazing livestock is considered as one of keys to the efficient and sustainable to the production of animals

OBJECTIVE

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- To assess grass species composition and nutritive value as influenced by soil characteristics in two different grazing areas under North West Province

RESEARCH QUESTIONS

- Are there variations in grass species composition and nutritive value as influenced by soil characteristics in two different grazing areas under North West Province?

MATERIAL AND METHODS

Study sites

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- Experimental site

	Potchefstroom	Mafikeng
municipality	Dr K.K	NMM
Rainfall	760 mm	400mm
altitude	1352	1323

- The soil in Mafikeng area is a clay loamy (CL) in texture and the soils resulting from this predominant limestone lithology are haplic lixisols and towards the town side, soils are ferallic arenosols that are highly weathered and iron-rich sandy textured soils and also lack any significant soil profile development (Frey, 2010).
- The Potchefstroom soil is consists of 15-30% vertic soil (Swelling, cracking clay).

STUDY SITE

- At each grazing camp in both study areas 10m x 10m homogenous vegetation units were marked in different directions to serve as replicates.
- In each HVU, three $1m^2$ quadrats were randomly put to sample soil and grass species.
- Soil samples analyses:
- PH
- Carbon
- nitrogen
- macro and micro minerals.

CHEMICAL ANALYSES

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❑ Proximate analyses:

- DM: samples were oven dried at 105°C for 12 h
- OM: samples were ashed at 600°C for overnight
- Total N: standard Kjeldahl method was used (AOAC 2005, method no. 984, 13)
- CP was determined by multiplying percentage N content by a factor of 6.25
- NDF and ADF was determined using ANKOM^{2000} Fiber analyser (ANKOM Technology, New York)
- Mineral was determined according to AgriLASA (1998).

•In Vitro DMD: determined using the ANKOM Daisy^{II} incubator (ANKOM, 2005).

Results: Soil micro and macro minerals.

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Table 1. Macro minerals (mg/kg) and organic carbon (%) found in two grazing areas			
Parameters mg/kg	Mafikeng (haplic lixisols)	Potch(Vertic soils)	SE
C%	0.68[b]	1.88[a]	0.018
Ph	4.3[a]	4.5[a]	0.187
N	1.67[b]	2.67[a]	0.527
P	1.67[b]	5.67[a]	0.67
K	128.33[b]	172.00[a]	1.795
Ca	334.33[b]	2194.00[a]	6.39
Mg	83.00[b]	1060.00[a]	10.87
Na	0.002[b]	33.00[a]	0.82

RESULTS CONT...

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Micro minerals (mg/kg) found in two grazing areas			
	Mahikeng	Potchefstroom	SE
Fe	3.95[b]	10.1[a]	0.037
Co	0.55[b]	2.16[a]	0.023
Zn	0.37[b]	2.41[a]	0.45
Mn	15.03[a]	38.26[a]	0.034

[ab]: Means with different letters in the same row are significantly different ($P<0.05$).

SE: standard error

Table 2. Life form, palatability, and ecological status of 18 grass species found in both grazing areas

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SPECIES	LIFE FORM	PALATABILITY	ECOLOGICAL STATUS
A. congesta	Per	LGV	Increaser II
F. africana	Per	MGV	Decreaser
D. eriantha	Per	HGV	Decreaser
S. obtuse	Per	HGV	Decreaser
H. contortus	Per	MGV	Increaser II
T. triandra	Per	HGV	Decreaser
E. rigidior	Per	MGV	Increaser II
S. nigrirostris	Per	MGV	Decreaser
C. plurinodis	Per	LGV	Increaser III
U. mosambicensis	Per	HGV	Increaser I
C. dactylon	Per	HGV	Increaser II

CONTINUE...

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Species	Life form	Palatability	Ecological status
C. ciliaris	Per	HGV	Decreaser
P. coloratum	Per	HGV	Decreaser
B. eruciformis	Ann	HGV	Increaser II
E. chloromelas	Per	MGV	Increaser II
E. curvula	Per	HGV	Increaser II
S. sphacelata	Per	HGV	Decreaser
B. brizantha	Per	MGV	Increaser I

Per=Perennial, Ann= annual, HGV=High Grazing Value, MGV=Medium Grazing value, LGV= Low Grazing Value

Table 3 Differences in biomass of grass species found at Mahikeng grazing areas.

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Species	Biomass(kg/hectare DM)
A. congesta	105.0[d]
F. africana	88.77[e]
D. eriantha	105.17[d]
S. obtusa	111.00[d]
H. contortus	94.46[e]
T. triandra	127.67[c]
E. rigidior	142.0[b]
S. Nigrirostris	166.67[a]
C. plurinodis	78.00[f]
U. mosambicensis	88.33[e]
C. dactylon	89.46[e]
SEM	3.33

[Abcdefg]: Means with different letters in the same column are significantly different ($P < 0.05$). SE. Standard error

Table 4. area. Differences in biomass of grass species found at Potchefstroom grazing

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Species	Biomass(kg/ha DM)
C. ciliaris	158.59[c]
T. triandra	152.79[cd]
P. coloratum	133.23[e]
B. eruciformis	83.61[g]
E. chloromelas	151.18[cd]
E. curvula	107.11[f]
S. sphacelata	193.57[b]
C. dactylon	157.30[cd]
A. congesta	103.09[f]
B. brizantha	273.91[a]
D. eriantha	145.37[d]
SEM	**2.65**

[Abcdefg]: Means with different letters in the same column are significantly different ($P < 0.05$). SE. Standard error

Table 5 Statistical significance (P value) of the effects of main factors on the chemical constituents (DM, CP, OM, NDF, ADF and ADL) of the common grass species from different grazing areas

Parameters						
	DM	**OM**	**CP**	**NDF**	**ADF**	**ADL**
Grass species	**NS**	**	**	**	**NS**	**NS**
Location	**NS**	**	**	**	**NS**	**
Grass *Location	**NS**	**	**	**	**NS**	**

NS = non significance

**=$P<0.05$

Table 6. The chemical composition of grass species found in Mahikeng grazing area.

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Parameters					
Species	**DM**	**CP g/kg DM**	**NDF g/kg DM**	**ADF g/kg DM**	**ADL g/kg DM**
A. congesta	963.70[f]	40.62[g]	765.15[b]	495.97[a]	160.76[c]
F. africana	977.67[abcde]	73.22[b]	754.82[bc]	452.37[ab]	139.86[e]
D. eriantha	981.0[abcd]	67.66[c]	721.71[d]	411.30[b]	133.30[e]
S. obtuse	977.63[abcde]	65.81[d]	795.49[a]	497.76[a]	218.31[a]
H. contortus	984.17[ab]	61.41[e]	717.83[d]	459.12[ab]	156.75[cd]
T. triandra	985.33 [a]	40.90[g]	729.66 [d]	496.62 [a]	189.42 [b]
E. rigidior	976.43[bcde]	64.74[d]	744.27[c]	419.13 [b]	139.17 [e]
S. nigrirostris	972.90[ed]	55.71[f]	729.03 [d]	500.35 [a]	194.26 [b]
C. plurinodis	975.10[cde]	60.38[e]	727.27 [d]	465.19[ab]	146.16 [de]
U. mosambicensis	968.93[ef]	80.31[a]	619.57[e]	431.21[b]	156.23[cd]
C. dactylon	981.97[abc]	55.65[f]	744.89[c]	466.39[ab]	134.91[e]
SEM	2.66	0.36	3.71	19.45	4.03

Table 7. The chemical composition of grass species found in Potchefstroom grazing area

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	Parameters					
Species	**DM g/kg DM**	**OM g/kg DM**	**CP g/kg DM**	**NDF g/kg DM**	**ADF g/kg DM**	**ADL g/kg DM**
C. Ciliaris	936.4[d]	910.19[a]	70.51[c]	758.29[c]	521.97[a]	91.43[g]
T. triandra	974.7[a]	909.70[a]	50.91[g]	745.72[cd]	453.54[d]	107.11[f]
P. coloratum	952.9[bcd]	888.06[b]	73.40[b]	676.78[f]	343.02[f]	75.30[h]
B. eruciformis	943.0[cd]	852.14[d]	71.53[c]	760.14[bc]	486.38[b]	159.75[a]
E. Chloromelas	944.7[cd]	904.07[a]	66.17[d]	774.46[b]	424.86[e]	109.63[e]
E. curvula	959.1[abc]	911.56[a]	55.27[f]	807.42[a]	471.14[c]	118.09[d]
S. sphacelata	948.5[cd]	847.37[d]	45.18[i]	741.84[d]	485.64[b]	117.12[d]
C. dactylon	954.5[bc]	872.23[c]	101.55[a]	774.38[b]	481.59[bc]	153.64[b]
A. congesta	953.3[bcd]	759.41[e]	49.42[h]	724.92[e]	491.72[b]	127.30[c]
B. brizantha	951.1[bcd]	889.71[b]	39.54[j]	750.60[cd]	441.07[d]	60.69[i]
D. eriantha	967.5[ab]	906.26[a]	57.24[e]	596.70[g]	487.45[b]	152.05[b]
SEM	5.14	3.86	0.44	4.98	4.59	0.75

[Abcdefg]: Means with different letters in the same column are significantly different ($P < 0.05$). SE. Standard error

Table 8 The in vitro dry matter degradability (g/kg DM) of grass species found in Mahikeng grazing area

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Species	DMD0	DMD24	DMD48
U. mosambicensis	290.65^{a}	366.02^{a}	480.43^{b}
H. contortus	258.30^{b}	292.07^{c}	412.15^{c}
D. Eriantha	245.06^{c}	309.28^{b}	516.87^{a}
F. africana	226.64^{d}	281.41^{c}	420.81^{c}
C. plurinodis	198.17^{e}	222.28^{d}	422.97^{c}
C. dactylon	190.79^{e}	232.62^{d}	416.42^{c}
E. rigidior	169.99^{f}	215.86^{e}	343.14^{e}
T. triandra	155.86^{g}	223.07^{d}	346.10^{e}
S. nigrirostris	143.77^{h}	167.56^{g}	336.53^{e}
S. obtuse	160.65^{fg}	181.07^{f}	383.9^{d}
A. congesta	110.84^{i}	190.22^{f}	378.42^{d}
SE	4.046	4.581	4.719

Parameters: DMD0= Dry Matter Degradability at 0 hours; DMD 24= Dry Matter Degradability at 24 hours after inoculation; DMD 48= Dry Matter Degradability at 48 hours after inoculation

^{abc}: Means with different letters in the same column are significantly different ($P < 0.05$).

SE. Standard error

Table 9. The in vitro dry matter degradability (g/kg DM) of grass species found in Potchefstroom grazing area

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Species	DMD0	DMD24	DMD48
P. coloratum	176.86[a]	364.56[a]	581.02[a]
B. brizantha	175.53[a]	255.20[b]	355.05[f]
D. eriantha	171.67[a]	250.23[b]	396.96[e]
B. eruciformis	150.51[bc]	215.36[d]	295.81[h]
T. triandra	147.11[c]	210.14[d]	428.63[d]
C. ciliaris	134.91[d]	213.22[d]	356.46[f]
E. curvula	129.68[d]	200.12[e]	307.28[g]
E. chloromelas	128.54[d]	193.67[e]	448.24[c]
C. dactylon	112.79[e]	228.94[c]	349.58[f]
A. congesta	94.65[f]	211.99[d]	269.21[i]
S. sephacelata	154.89[b]	217.39[d]	458.24[b]
SE	2.089	2.665	2.549

Parameters: DMD0= Dry Matter Degradability at 0 hours; DMD 24= Dry Matter Degradability at 24 hours after inoculation; DMD 48= Dry Matter Degradability at 48 hours after inoculation

[abc]: Means with different letters in the same column are significantly different ($P < 0.05$).

SE. Standard error

Discussion and conclusion

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- These two areas had different grass species with only four common with significance difference on their nutrition value between the institutional farms that might have been affected by soil (type, pH, fertility) and climatic condition.

- Further more supplementation might be required to those grass species with low CP value for better animal performance.

- Furthermore, research is needed to assess the nutrition value of these grass species at different growing stages and seasons in these two study areas so as to know to supplementation that may be needed when grass species have deteriorated in their nutritional composition.

CONCLUSION

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» THANKS