The herbaceous yield, plant and soil nutrient content contribution of various leguminous pastures planted in Lushington communal area of the Eastern Cape Province, South Africa

BY

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INTRODUCTION

- Legumes are important in farming systems because they:
  - Fix atmospheric nitrogen
  - Have high nutritive value and improve the quality of plants grown with them
  - Improve soil quality (i.e. increase soil organic matter, increase soil N and soil structure and recycle nutrients).

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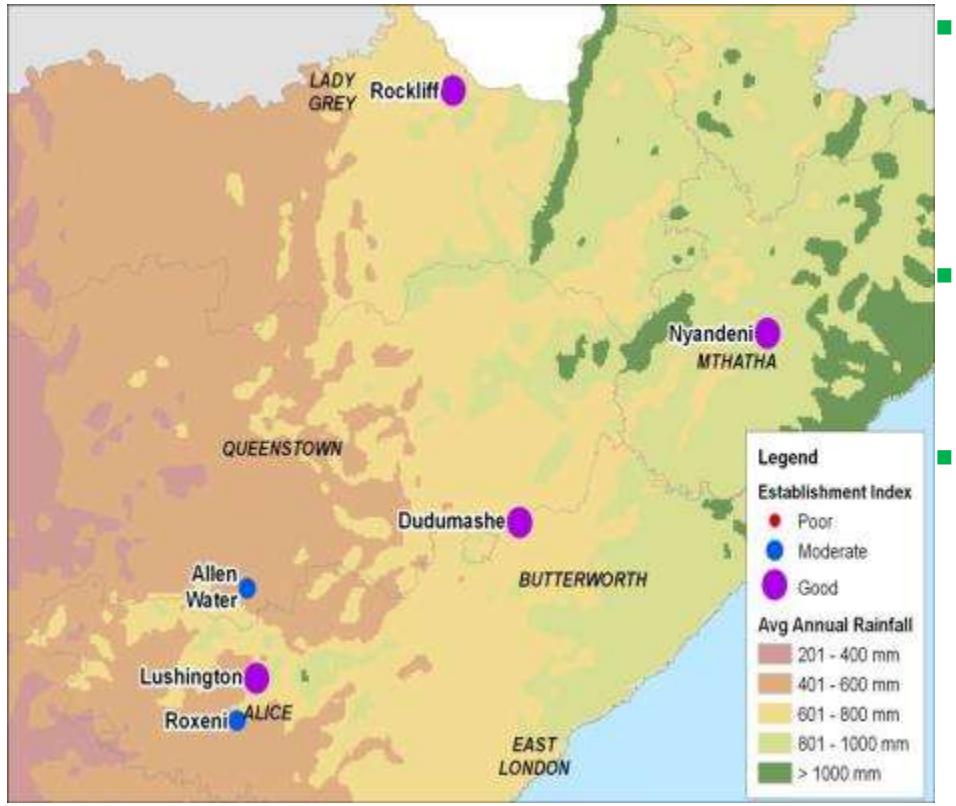
WHERE WAS THE STUDY DONE?



- Part of the Amothole district municipality located at 26˚82’00”S; 32˚64’00”E and 846 m altitude.
- Lushington falls into the Dohne sourveld and The soils in the area are categorised as Wesley soil forms.
- Receives 600-700mm annual rainfall.

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HOW WAS THE STUDY CONDUCTED?

- A one hectare old land was planted to fourteen legume species.
- Study was done on four legume species (i.e. *T. repens, T. vesiculosum, L.cuneata* and *L.corniculatus*).
- Plots were replicated twice in a RCBD design.
- Interspacing was 2.5m and planting was done by drilling seeds with the Aitchison mini seeder in between the natural grasses.
- Once off application of superphosphate (P) was done during planting.
- Planting was done in March 2007.

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HOW WAS THE STUDY CONDUCTED? Cont.

- Five exclusion cages were put per plot to protect the sampling areas
- Plants and soil were sampled in the protected areas and sampling was done over four seasons (i.e. Spring, Summer, Autumn and Winter).
- Soil and plant samples were analyzed at the Dohne Laboratory.
- All data was analyzed using two way ANOVA of the generalized linear model procedure of SAS (2001) stat. program.
- Treatment and season were the main factors; plant and soil nutrient elements were dependent variables

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WHY WAS THE STUDY CONDUCTED?

Aim of the project

- Quantify and measure the TDM yield production, the soil nutrient restoration ability of the four spp.
- Determine the effect of the four leguminous spp. on the companion native grasses

Specific objectives

- To determine the effect of treatment and season on the general nutrient levels of both legumes and the native pastures growing alongside with legumes.
- To quantify the total dry matter yield production and determine whether or not the yield quantity is influenced by season and treatment.
- To determine whether or not legume planting in the old arable lands improves soil quality(i.e. soil P,N and SOC).

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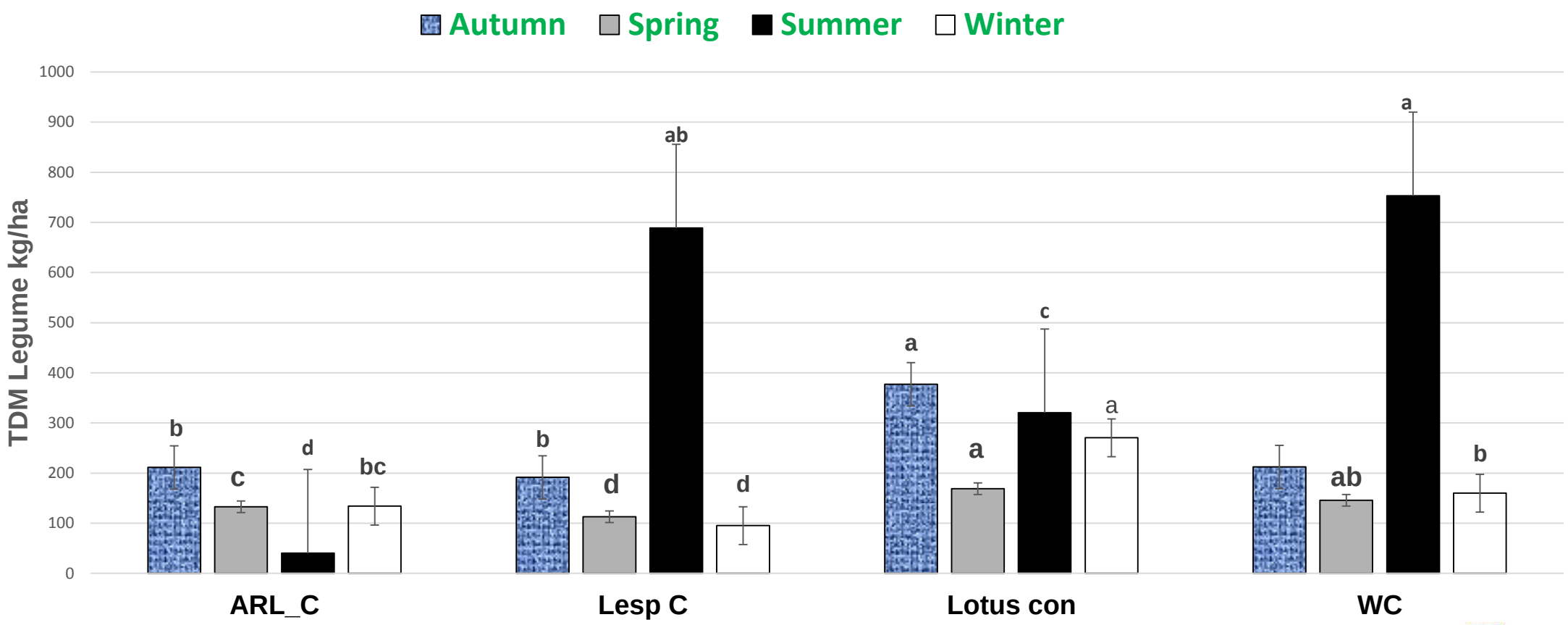
RESULTS

Effect of season on the TDM legume yield (kg/ha) at Lushington



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RESULTS cont.

The effect of season on the TDM yield of herbaceous material (Kg/ha) produced at Lushington

Herbaceous spp.	Spring	Summer	Autumn	Winter	Std.err.
TDM legume	234.30^{b}	949.95^{a}	907.35^{a}	176.86^{c}	406.00
TDM grass	737.83^{c}	2095.88^{a}	1648.60^{b}	1220.14^{b}	216.59
TDM forb	102.78^{b}	3055.60^{a}	2472.38^{b}	1424.83^{c}	472.43

Small letter values with different superscripts within the same row depict significant difference (P<0.05).

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RESULTS cont.

Effect of treatment on the species TDM yield per Kg at Lushington

	Ctrl	L.cuneata	L.cornilatus	T.repens	T.vesiculosum	Std. Err.
TDM legume	0	1684.91^{a}	284.35^{b}	163.55^{c}	135.65^{c}	406.00
TDM Grass	992.06^{c}	998.53^{c}	1612.40^{b}	1672.40^{b}	1852.67^{a}	242.16
TDM Forb	100.18^{b}	107.35^{b}	160.95^{a}	75.10^{c}	33.62^{d}	33.62
Overall TDM yield	1092.27^{c}	2790.76^{a}	2057.70^{a}	1911.10^{b}	2124.10^{a}	528.19

Small letter values with different superscripts within the same row depict significant difference (P<0.05).

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RESULTS cont.

The effect of treatment on the plant species Crude Protein (%) levels.

Nutrients	Species	Control	*T.vesiculosum*	*T.repens*	*L.corniculatus*	*L.cuneata*	Std. err.
CP							
	Grass	1.10^{d}	1.55^{b}	1.74^{a}	1.53^{c}	1.52^{c}	0.61
	Legumes	0.00	1.34^{c}	1.06^{d}	1.49^{b}	1.76^{a}	0.61

Small letter values with different superscripts within the same row depict significant difference (P<0.05).

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RESULTS cont.

The interaction between plant species and season on the plant crude protein (%) levels.

Nutrients	Species	Spring	Summer	Autumn	Winter	Std.err.
Crude Protein						
	Grass	1.26^{b}	1.98^{a}	0.88^{c}	0.58^{d}	0.14
	Legumes	1.74^{b}	1.38^{c}	2.00^{a}	0.71^{d}	0.14

Small letter values with different superscripts within the same row depict significant difference (P<0.05).

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RESULTS cont.

Interaction between season and treatment on the soil organic carbon content at Lushington

Season	Control	*L.cuneata*	*L.cornilatus*	*T.repens*	*T.vesiculosum*
Spring	1.03[a]	1.44[a]	0.90[b]	0.91[b]	0.42[c]
Summer	1.03[a]	0.27[c]	0.70[b]	0.72[b]	0.12[d]
Autumn	0.13[c]	0.49[b]	0.49[b]	0.04[d]	0.75[a]
Winter	0.004[d]	0.04[c]	0.18[a]	0.18[a]	0.09[b]
Std. err.	0.87	0.23	0.083	0.04	0.04

Small letter values with different superscripts within the same row depict significant difference (P<0.05).

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RESULTS cont.

Effect of treatment on the macro nutrient content of the soil at Lushington.

Nutrients	Control	*T.vesiculosum*	*T.repens*	*L.corniculatus*	*L.cuneata*	Std. err.
Nitrogen (%)	0.14^{a}	0.14 ^{a}	0.12 ^{ab}	0.13 ^{ab}	0.14 ^{a}	0.12
Phosphorus (mg/kg)	23.3^{e}	24.47^{d}	31.80 ^{a}	26.00^{c}	28.04 ^{b}	2.14

Small letter values with similar superscripts within the same row depict non-significant difference (P>0.05).

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RESULTS cont.

The effect of season on the macro nutrient content levels of the soil at Lushington.

Nutrients	Spring	Summer	Autumn	Winter	Std. err.
Nitrogen (%)	0.11^{c}	0.11^{c}	0.16^{a}	0.14^{ab}	0.003
Phosphorus (mg/kg)	36.28^{a}	24.59^{b}	22.58^{d}	24.23^{c}	1.93

Small letter values with different superscripts within the same row depict significant difference (P<0.05).

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CONCLUSION

❖ **Effect of season on forage quantity; quality:**

- **Summer season resulted to the highest overall total dry matter yield production while winter led to the lowest TDM production.**
- **Grass and legume yield production dropped in winter but the grass quantity produced remained higher than that of the legumes.**
- **Grass and legume CP higher in summer and lower in winter.**

❖ **Effect of season on soil quality (P,N and OC):**

- **Highest P levels measured during spring and the lowest during Autumn; no distinct effect on SOC and no significant differences on soil N.**

❖ **Effect of treatment on forage quantity; quality:**

- **Control plot produced lower dry matter yield while higher DM yield production achieved in the *L.cuneata* plot.**

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CONCLUSION cont.

- Higher grass CP level in the *T. repens* plot and lower CP in the control plot
- Higher legume CP in the L.cuneata plot and lower CP in the T.repens plot

❖ **Effect of treatment on soil quality (P,N and OC):**

- Soil P levels higher in the T. repens plot and lower in the control plot
- No significant differences in N levels across treatments
- Fluctuations in soil OC levels throughout treatments

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RECOMMENDATIONS

- In areas like the Eastern Cape Province legume inclusion in the old arable lands is recommended as it has the potential to bridge the forage quality and quantity deficit that usually occurs during the drier seasons like winter and early spring.
- Long term studies that will measure the long term effect of legume planting on soil N and OC should be carried out.
- Legumes are recommended for use as the supplementary feed for improved animal performance.
- Nitrogen fixation trends of various forage legumes have to be studied further.

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THE END

- Enkosi ngokundiboleka indlebe

- Thank you for listening to me

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