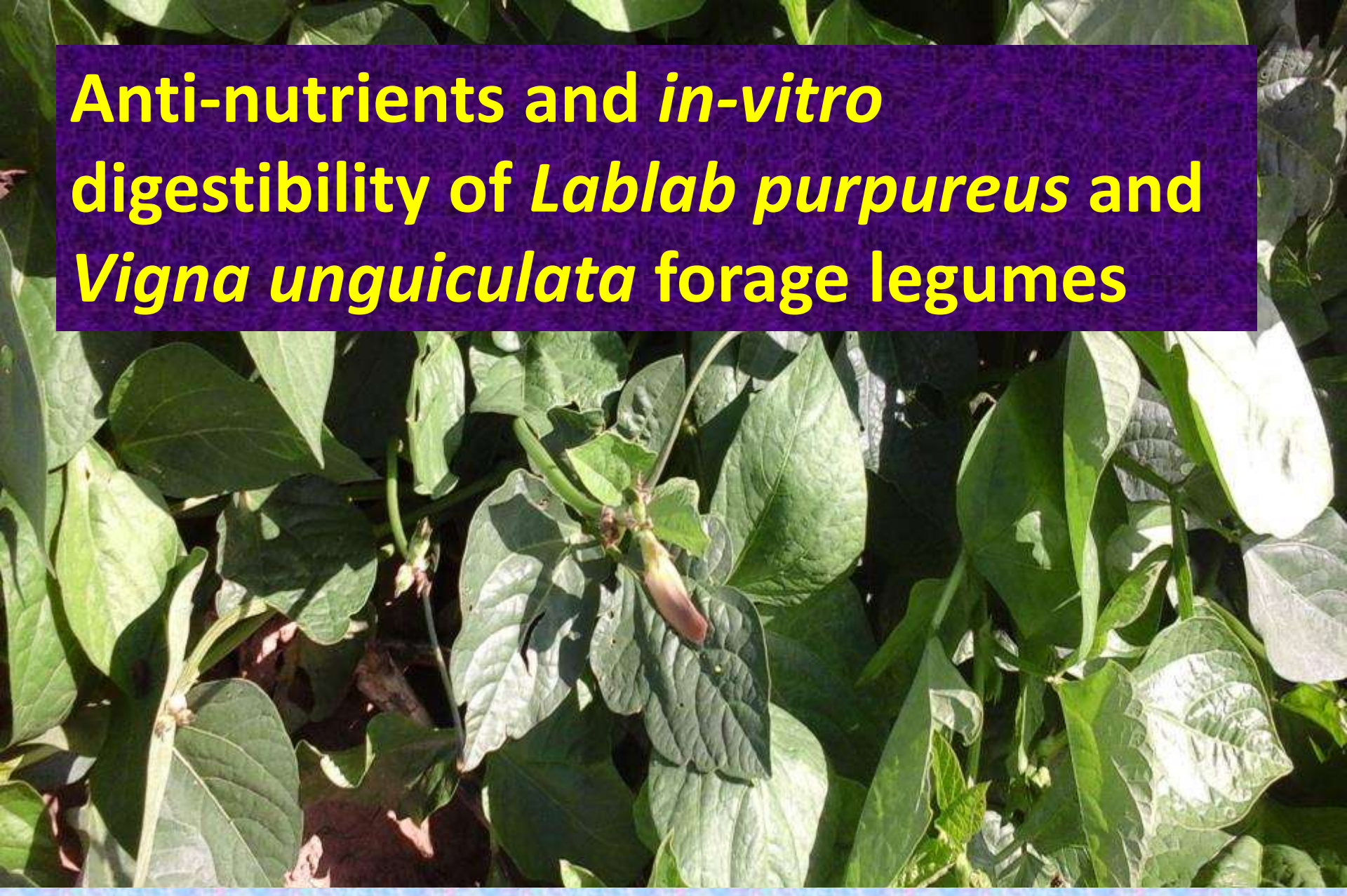
Anti-nutrients and *in-vitro* digestibility of *Lablab purpureus* and *Vigna unguiculata* forage legumes



Washaya Soul , Johnfisher. Mupangwa and Voster. Muchenje.

Introduction

- Feed shortage, both in quantity and quality leading constraint to good animal performance in sub-Saharan Africa (Yayneshet *et al.,* 2009).
- Natural pasture and crop residues are the main feed sources, extensive sytems
- These feedstuffs have very low CP levels (< 8%) and high NDF content (>55%) (Akinlade *et al.,* 2005).
- Feedstuffs inadequate to provide year round supply of nutrients beyond maintenance level (Paulsen *et al*., 2014).

- Forage legumes significantly improve rumen MPS.
- Dry matter digestibility (DMD) is the proportion of dry matter in feed that can be digested by the animal.
- Organic matter digestibility (OMD) is the proportion of organic matter in dry matter that can be digested by the animal
- **Digestibility affected by**: stage of growth, legume species, animal species, sex, anti-nutrient content and lignin content
- Forage legumes posses anti-nutritional factors ; limit digestibility

Materials and Methods

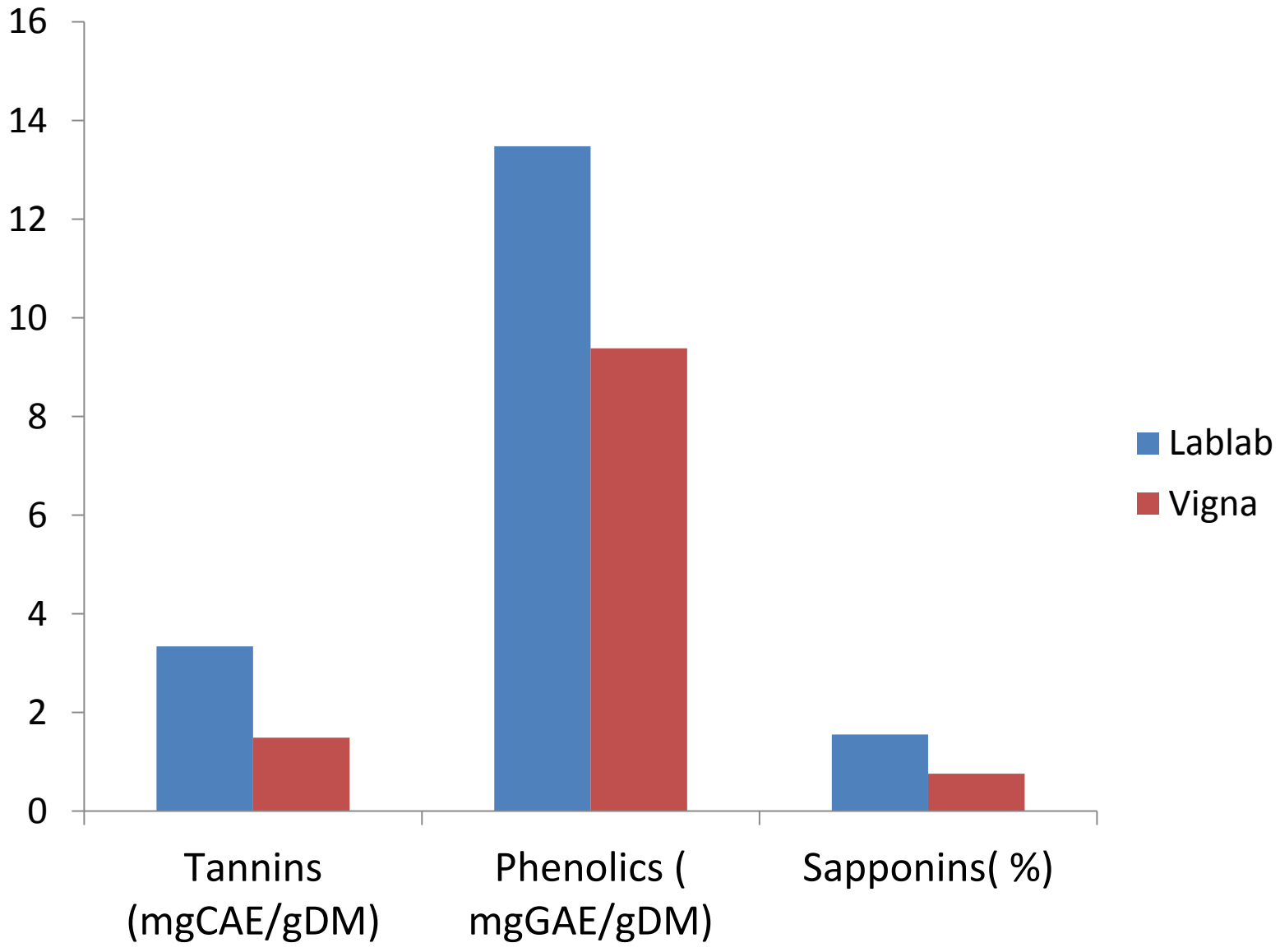
- Study site - University of Fort Hare Research Farm
- Plant establishment
- Forage Samples – harvested, dried at 60 ^{0}C for 48 hours, milled through a 1 mm screen
- Anti-nutrients – tannins (vanillin method Sun *et al.* (1998) , phenolics(Folin-Ciocalteu's Samatha *et al*. 2012) and saponins(n- butanol method , Omoruyi *et al*. 2012)
- ***In-vitro*** analysis - Tilley and Terry method, (1963), modification as suggested by Van Soest (1994)
- ME and FME were estimated using the following formulas:
- **ME(MJ/kgDM) = 0.0157× DOMD(g /kgDM),**AFRC, (1993)
- **FME MJ kgDM = ME × (0.00136×ODM – 0.00000115×ODM^{2}),** AFRC, (1993)
- Inoculum – obtained from Adelaide abattoir

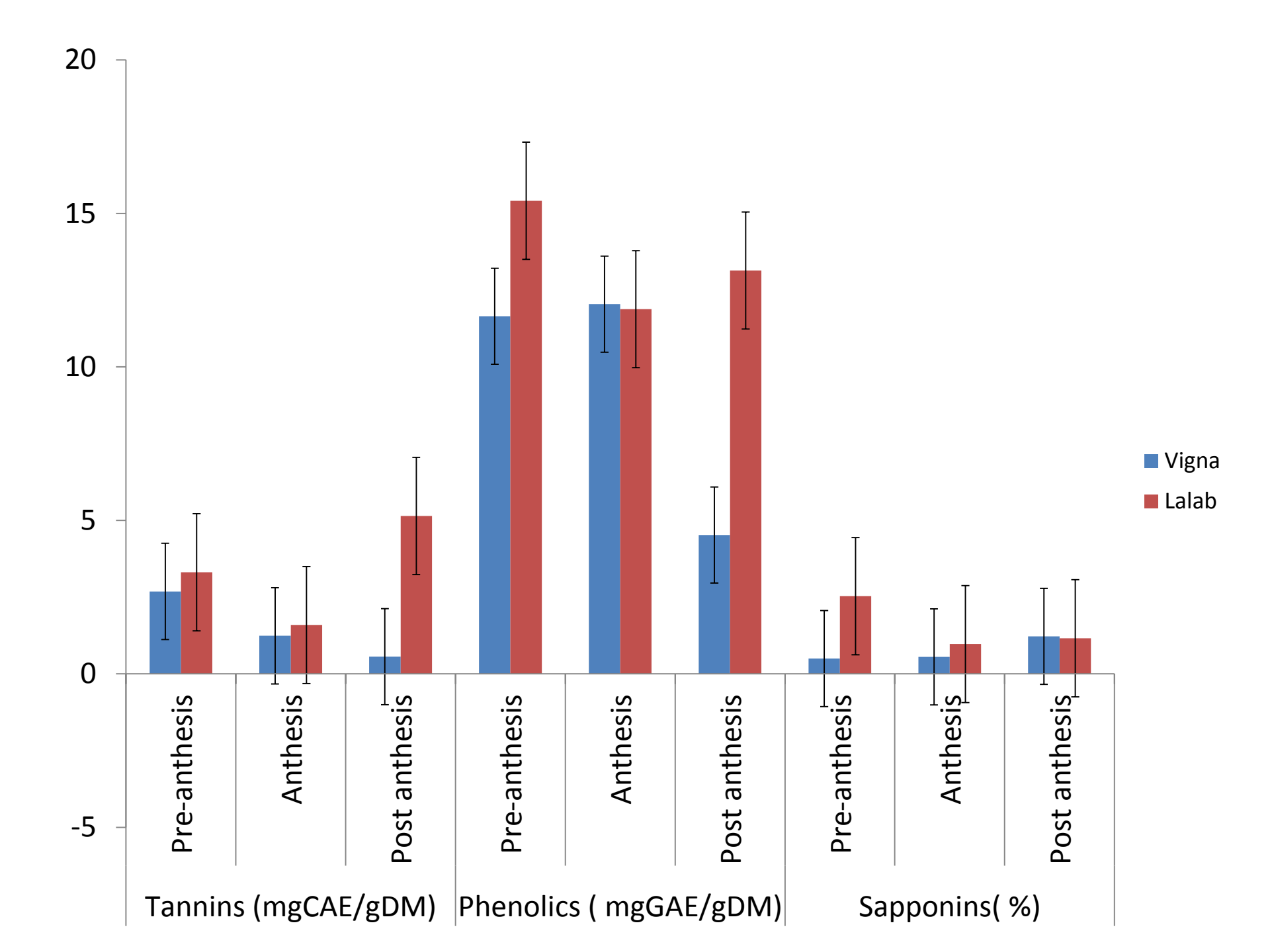

VP
VA
VPA


LLA
LLP
LLPA

Results

- Lablab exhibited higher ($P < 0.05$) average tannin, phenolic and saponin content compared to Cowpea; 3.35 mg catechin equivalent CAE/g of dry matter (DM) *vs*. 1.49 mg CAE /g DM; 13.5 mg gallic acid equivalent (GAE)/g DM *vs*. 9.40 mg GAE/g DM and 1.55% *vs*.0.75%, respectively
- Forages showed a general decline in phenolic content with advancing stage of growth ($P < 0.05$).
- General increase with stage of growth for saponins in Cowpeas, yet Lablab showed a decline with advancing stage of growth ($P < 0.05$).

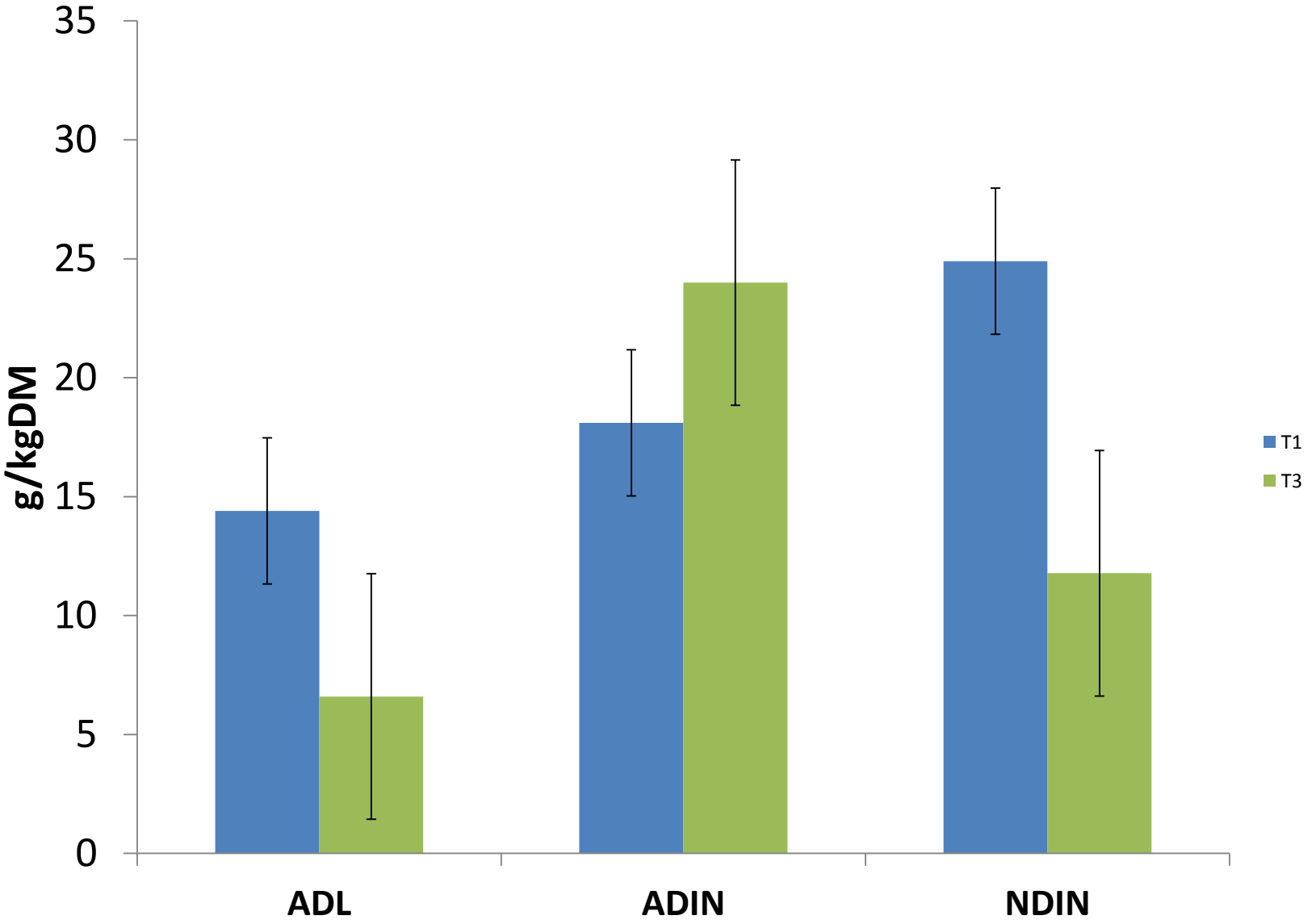

16
14
12
10
8
6
4
2
0
Tannins (mgCAE/gDM)
Phenolics (mgGAE/gDM)
Sapponins(%)
Lablab
Vigna


20
15
10
5
0
-5
Vigna
Lalab
Pre-anthesis
Anthesis
Post anthesis
Pre-anthesis
Anthesis
Post anthesis
Pre-anthesis
Anthesis
Post anthesis
Tannins (mgCAE/gDM)
Phenolics (mgGAE/gDM)
Sapponins(%)

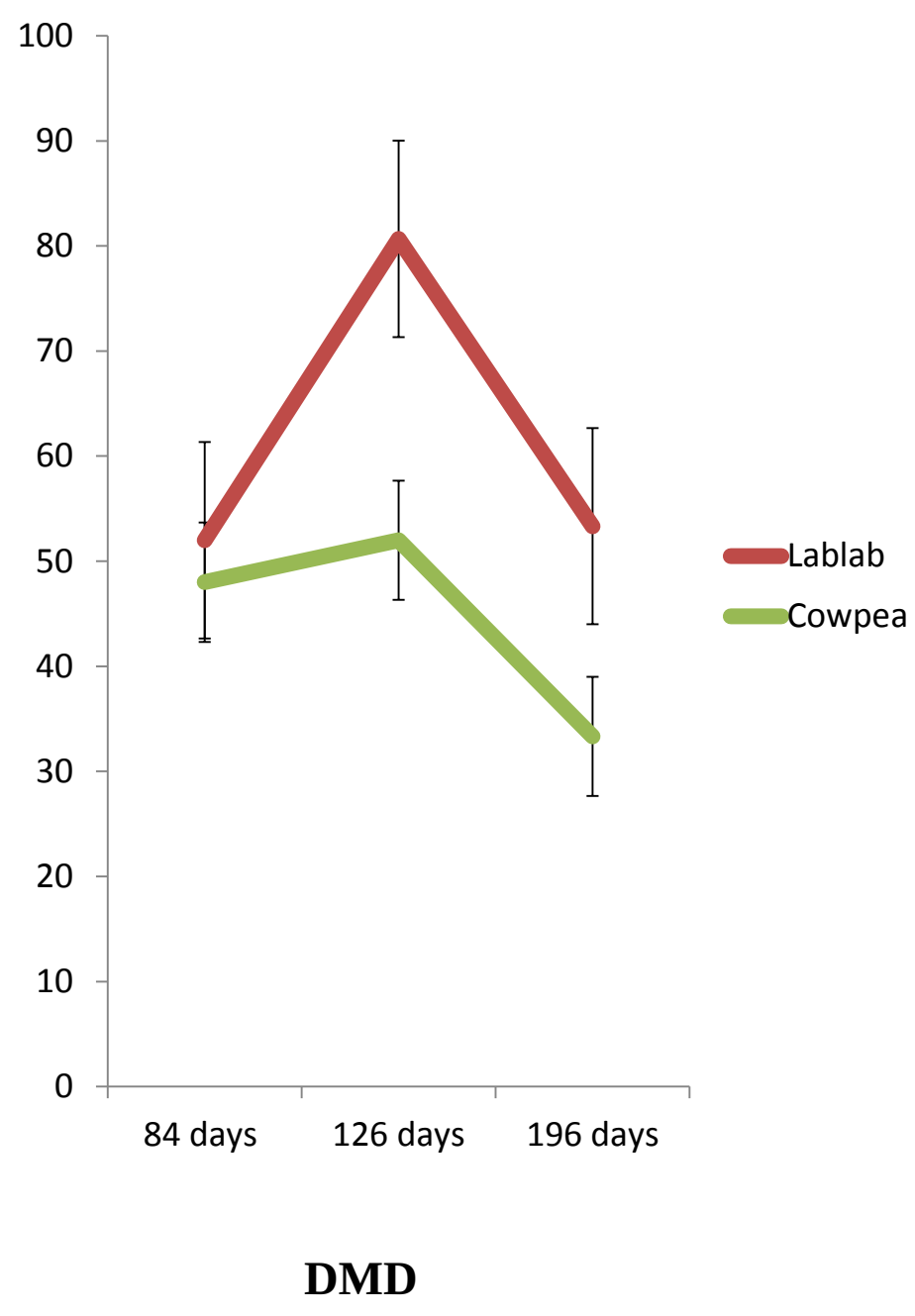
- OMD and DMD was significantly ($P < 0.05$) affected by inoculum source for each forage species.
- OM digestibility is lower ($P < 0.05$) in Cowpea (19.44%) than Lablab (39.6%).
- Digestibility was higher when cattle inoculum was used ($P < 0.05$) than sheep inoculum (OM 32.24% and DM 45.8% vs 26.8% and 35.15%) for both forages.
- Lablab exhibited higher DMD and OMD than Cowpea (41.13, 39.63% vs 39.86, 19.44%;) for DM and OM, respectively ($P < 0.05$).
- Lablab showed higher ($P < 0.05$) DM digestibility (50.5%) when cattle inoculum was used while Cowpea recorded higher digestibility (38.54%) when sheep inoculum was used.

Table 1: Digestible OM,% DM %, ME (MJ/kgDM) and FME (MJ/kgDM) f or Lablab and Cowpea forages grown in the Eastern Cape Province of South Africa

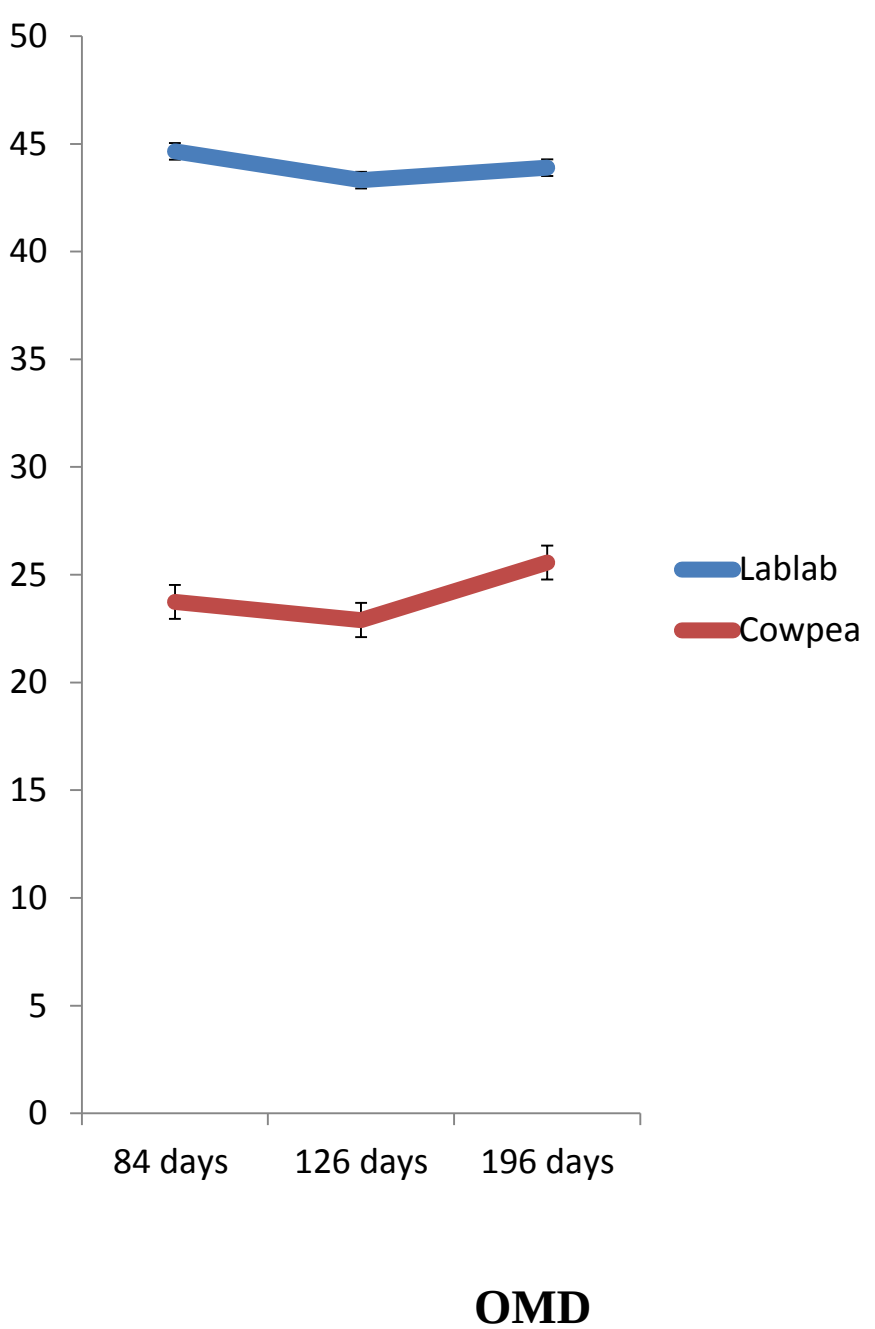
Animal (S)	Forage (L)	DMD	OMD	ME	FME
Cattle	Lablab	50.50[a]	44.13[a]	6.92[a]	5.17[a]
	Vigna	41.17[b]	20.36[c]	3.20[b]	2.67[b]
Sheep	Lablab	31.75[d]	35.19[b]	5.53[a]	4.13[a]
	Vigna	38.54[c]	18.53[c]	2.19[b]	1.83[b]
SE		1.753	2.830	0.149	0.149
Significance	S	***	***	NS	NS
	L	***	***	***	***
	SxL	***	***	***	***



Chemical composition of ADL, ADIN and NDIN for Lablab (T_3) and Cowpea (T_1)


100
90
80
70
60
50
40
30
20
10
0
84 days
126 days
196 days
Lablab
Cowpea

DMD


50
45
40
35
30
25
20
15
10
5
0
84 days
126 days
196 days
Lablab
Cowpea

OMD

Discussion

- Dry matter digestibility is influenced by stage of growth Mupangwa (2006) and Ravhuhali *et al.* (2010) - **lignification**
- Lignification, high NDF content synchronously reduce hydrolysis-degradation
- High fibre diets would require fribrolytic protozoa than cellulolytic bacteria to achieve enough fermentation- methane
- Cowpea had lower ME and FME values which might not be sufficient for maintenance of adult sheep as observed by (Ahmed and El Hag, 2003). Adult sheep require 5MJ ME per day.

- The extent to which ME is utilized by the animal is unknown (Das *et al.*, 2014)
- FME influence microbial crude protein yield (Das *et al.*, 2014).
- RMPS determine the extent of degradation ,(Tibayungwa *et al.*, 2011).
- Tannin content of 50g/kgDM not detrimental but profitable in ruminants (Min *et al.* 2003)
- Saponin content of 2 -4% influence digestibility in sheep (Das *et al.,* 2012)
- Phenolic levels did not influence digestibility (Makkar, 2003; Abarghuei *et al*., 2014)

Conclusions

- Lablab and Cowpea have acceptable digestibility coefficients (ruminants).
- Digestibility depend on the level of fermentable carbohydrates, ME, tannin content.
- Reduced by the amount of NDF and the extant of lignification
- Digestibility affected by inoculum source.
- Lablab exhibit higher digestibility values than Cowpeas irrespective of stage of harvesting.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