

PRM -03

Herbage Yield and Proximate Composition of Five Forage Legumes in Benin City, Southern Nigeria

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Abstract

Although forage legumes possess high quality herbage for ruminant feeding and increase soil fertility when incorporated, they may differ significantly in yields and quality. A field experiment conducted at the Department of Crop Science, Faculty of Agriculture, University of Benin, Benin City; evaluated the herbage yields and proximate composition of five (5) forage legumes (*Mucuna pruriens*, *Centrosema pascuorum*, *Lablab purpureus*, *Stylosanthes guianensis* and *Arachis hypogaea*). Legumes constituted five treatments fitted into a randomized complete block design (RCBD) with four replications. Data were collected on fresh and dry herbage weights, including proximate composition (crude protein, crude fibre, ether extract, ash and nitrogen free extract) at 14 weeks after sowing. *Arachis hypogaea* produced the significantly heaviest fresh herbage yield of 0.17 t ha⁻¹ followed by *Lablab purpureus* with 0.12 t ha⁻¹. However, both legumes recorded similar dry herbage yield (0.05 t ha⁻¹). The significantly highest crude protein (22.89%), crude fibre (17.37%) and nitrogen free extract (54.51%) concentrations were obtained from *Mucuna pruriens*. *Stylosanthes guianensis* yielded the highest ($p \leq 0.05$) ether extract (2.37%) while *Lablab purpureus* furnished the highest ($p \leq 0.05$) ash (5.23%) concentrations. The relatively high herbage and crude protein yields produced by the legumes warrant their utilization for forage, fodder and soil improvement in the humid rainforest zone of Nigeria.

Keywords: *Mucuna pruriens*, *Lablab purpureus*, fresh herbage, dry herbage, crude protein

Introduction

Forage legumes fix nitrogen, circulate soil nutrients, retain water and release organic matter to the soil (Stagnari *et al.*, 2017). They are ideal livestock feed that man does not compete with animals to consume. Legumes with high herbage and crude protein yields stabilize subsequent crop yields and may avert crop failure (Holman *et al.*, 2015) through increased soil fertility. However, within species and across locations, legumes differ in ability to utilise soil available P. This contributes to large differences between plant species and cultivars within species in herbage and proximate composition yields (Rao *et al.*, 1999). It is desirable to ascertain the yield and quality potentials of various legumes to find niches for them in the farming system.

The objective of this study was to determine the herbage yield and proximate composition of five forage legumes in Benin City, southern Nigeria.

Materials and Methods

The field trial was conducted during the late growing season (November 2016 to March 2017) at the teaching and research farm of the Faculty of Agriculture, University of Benin, Benin City, Nigeria (Latitude 6°20'17"N and Longitude 5°37'32"S at 88m above sea level. The mean annual rainfall is 1761.9 mm while temperature range is 25 - 28°C) (Accuweather, 2017). The treatments were five forage legume (*Arachis hypogaea*, *Stylosanthes guianensis*, *Centrosema pascuorum*, *Mucuna pruriens* and *Lablab purpureus*). The experiment was laid out in a randomized complete block design (RCBD) with four replications.

The existing vegetation on the field was sprayed with a 1.8% glyphosphate herbicide (360 ml active ingredient per 20 litres of water) before marking out the plots of 5m x 5m dimension. Seeds were sown on the 24th of November, 2016. The large seeded legumes (*Arachis hypogaea*, *Lablab purpureus* and *Mucuna pruriens*) were sown at the rate of 2 seeds per hole and inter and intra row spacing of 30cm by 30cm. The small seeded legumes (*Centrosema pascuorum* and *Stylosanthes guianensis*) were scarified and drilled at an inter-row spacing of 30 cm. After sowing, plots were irrigated twice daily for two weeks and reduced to once daily irrigation for two more weeks, to aid good establishment of seedlings. Plots were weeded manually at the second and fourth weeks after sowing.

Data were collected on fresh and dry herbage yields including proximate composition (AOAC, 2012) at 14 weeks after sowing. Data collected were subjected to Analysis of Variance (ANOVA) using SAS (Statistical Analysis System) software version 9 (SAS, 2000). Means were separated with Least Significance Difference (LSD) at 0.05 level of probability.

Results and Discussion

Table 1 shows that the significantly highest fresh herbage weight (0.17 t ha⁻¹) was recorded by *Arachis hypogaea* followed by *Lablab purpureus* (0.12 t ha⁻¹) while other legumes were similar. *A. hypogaea* and *L. purpureus* accumulated similar

dry herbage yield (0.05 t ha⁻¹) that was significantly heavier than that of other legumes that were at par. These results imply that these legumes can provide substantial quantities of good herbage to supplement grasses for ruminant feeding within a relatively short interval of 14 weeks. Groundnut haulm is a popular feedstuff and lablab was advocated as good feed for rabbits and other monogastric livestock (Bawa *et al.*, 2013). These legumes could also be utilized for soil fertility improvement.

Table 1: Fresh and dry herbage yields of legume crops at 14 WAS

Legume	Herbage yield (t ha ⁻¹)	
	Fresh	Dry
<i>Arachis hypogaea</i>	0.17a	0.05a
<i>Lablab purpureus</i>	0.12b	0.05a
<i>Stylosanthes guianensis</i>	0.06c	0.04b
<i>Mucuna pruriens</i>	0.06c	0.03b
<i>Centrosema pascuorum</i>	0.06c	0.03b
LSD (0.05)	0.016	0.008

Means with different alphabets along a column are significantly different at 0.05 level of probability

Table 2 shows that *Mucuna pruriens* produced the significantly highest crude protein (22.89%) and crude fibre (17.37%) concentrations among the legumes. Next in rank among legumes was *Lablab purpureus* with 20.64% and 16.89 % for crude protein and crude fibre, respectively. The crude protein values were similar to those published for lablab (Hassan *et al.*, 2013) and *Mucuna* (Njarui *et al.*, 2003). Due to their high crude protein concentrations, these legumes may be used to improve the quality of small ruminant manure (Njarui *et al.*, 2003) and thereby soil fertility which enhances crop production consequently.

Lablab recorded the significantly highest ash concentration (5.23 %) among the legumes signifying the presence of high levels of macro and micro-minerals. Potassium, phosphorus, calcium, copper, iron, and zinc concentrations are higher in legumes compared to grasses. This is probably why amaranth performed best following lablab than other legumes in rotation (Ogedegbe and Falodun, 2016). This lablab attribute should be exploited further for increased vegetable production. The significantly highest NFE concentration produced by *Mucuna pruriens* infers that this legume can provide adequate quantities of soluble carbohydrates to ruminants that consume it.

Table 2: Proximate composition (%) of legume crops at 14 WAS

Legume	CP	CF	EE	Ash	NFE
<i>Arachis hypogaea</i>	17.07e	16.37c	2.16b	4.91c	50.01d
<i>Lablab purpureus</i>	20.64b	16.89b	2.02c	5.23a	45.71e
<i>Stylosanthes guianensis</i>	17.82d	14.41e	2.37a	3.49d	53.00b
<i>Mucuna pruriens</i>	22.89a	17.37a	1.96d	4.99b	54.51a
<i>Centrosema pascuorum</i>	18.55c	15.57d	1.87e	3.46e	52.73c
LSD (0.05)	0.137	0.001	0.014	0.032	0.031

Means with different alphabets along a column are significantly different at 0.05 level of probability. CP=Crude protein, CF=Crude fibre, EE=Ether extract, NFE=Nitrogen free extract

Conclusion

Arachis hypogaea produced the highest fresh and dry herbage yields whereas *Mucuna pruriens* furnished the significantly highest crude protein, crude fibre and nitrogen free extract concentrations among the legumes.

References

- Accuweather (2017). Benin City, Nigeria local weather. <http://www.accuweather.com/en/ng/Nigeria-weather>. Assessed on 12th August 2017.
- AOAC (2012). *Official Methods of Analysis. 20th Edition*, Association of Analytical Chemist, Washington, DC
- Bawa, G.S., Abia, E.E., Omege, J.J., Hassan, M.R. and Abdu, S.B. (2013). Nutritive value of *Dolichus lablab* (*Lablab purpureus* C.V. Rongai) forage cut at different stages of growth on performance of weaned rabbits. *Nigerian Journal of Animal Science*, 15: 23-36.
- Hassan, M.R., Muhammad, I.R., Joktan, G.E., Amodu, J.T., Abdu, S.B., Abdulahi, B., Adamu, H.Y., Yashim, S., Tamburawa, M.S., Ado, U. and Abubakar, S.A. (2013). Effect of planting pattern and irrigation frequency on forage yield and chemical

- composition of lablab (*Lablab purpureus* (L.) Sweet) in combination with maize (*Zea mays* L.). *Nigerian Journal of Animal Science*, 15:179-190.
- Holman, J.D., Roberts, T., Maxwell, S., Kisekka, I. and Obour, A. (2015). Fallow replacement crop (cover crops, annual forages, and short-season grain crops) effects on available soil water. *Kansas Agricultural Experiment Station Research Reports*, 1(5):
- Njarui, D.M.G., Mureithi, J.G., Wandera, F.P. and Muinga, R.W. (2003). Evaluation of four forage legumes as supplementary feed for Kenya dual-purpose goat in the semi-arid region of Eastern Kenya. *Tropical and Subtropical Agroecosystems*, 3:65 – 71.
- Ogedegbe, S.A. and Falodun, E.J. (2016). Evaluation of seven forage legumes for Biological Nitrogen Fixation (BNF) and their effect on *Amaranthus cruentus* in a Fluvisol (river sand) *American Journal of Experimental Agriculture*. 11(3):1-6.
- Rao, I.M., Friesen, D.K. and Hoorst, W.J. (1999). Opportunities for germplasm selection to influence phosphorus acquisition from low-phosphorus soils. *Agroforestry Forum*, 9(4): 13 – 16.
- SAS (2002) Statistical Analysis System. SAS Institute User's Guide Version 9, Garry, N.C, USA.
- Stagnari, F., Maggio, A., Galieni, A. and Pisante, M. (2017). Multiple benefits of legumes for agriculture sustainability: an overview. *Chemical and Biological Technologies in Agriculture*, 4(2): 1 – 13.