# COMPARATIVE HERBAGE YIELD AND PROXIMATE COMPOSITION OF *MUCUNA PRURIENS* AND *SPHENOSTYLIS STERNOCARPA* INTERCROPPED WITH *MEGATHYRSUS MAXIMUS*

***Omotoso, S. O.[1], Babayemi, O. J.[2] and Ajayi, F. T.[1]**
[1]Institute of Agricultural Research and Training, Obafemi Awolowo University, Moor Plantation, Ibadan, Nigeria.
[2] Department of Animal Science, University of Ibadan, Ibadan, Nigeria.
**Corresponding: author:* tobsum2006@gmail.com

## ABSTRACT
*Mucuna pruriens* (MP) and *Sphenostylis sternocarpa* (SS) are legume species potentially rich for feeding ruminants. The competition for growth resources in grass-legume intercrop can affect their yields and nutrients. Information on herbage yields and proximate content of MP and SS intercropped with *Megathyrsus maximus* (MM) is limited. In a randomized complete block design (r=3), MM was intercropped, with MP and SS in ratios 75MM:25MP (T1), 50MM:50MP (T2), 75MM:25SS (T3) and 50MM:50SS (T4), while MP (T5) and SS (T6) were soles. Yields and proximate contents of *M. pruriens* and *S. sternocarpa* at 8, 10 and 12 weeks of harvests were evaluated. Yields of sole *M. pruriens* were higher than sole *S. sternocarpa* and legumes from the intercrops. *M. pruriens* and *S. sternocarpa* from the intercrops (50:50), respectively, out yielded those from a 75:25 ratio. Biomass yield at week 10 was more than other harvest ages while dry matter yield of 8th week and 10th week harvests were similar. Crude Protein (CP) of *M. pruriens* and *S. sternocarpa* (21.65 and 21.34%, respectively), from sole stands were higher than the CP range (20.75-20.89%) of the legumes from the intercrops (T1, T2 and T3), except T4 (21.82%). The crude fibre (CF) of legumes for the soles and the intercrops were relatively similar. The CF of both legumes increased with advanced harvest ages, while other proximate contents declined as harvest ages increased. In conclusion, the herbage yield of *M. pruriens* was more than *S. sternocarpa,* and harvest ages influenced yields and proximate content of both legumes.
**Keywords: Herbage yield, Intercropping, *Mucuna pruriens*, Nutrients, *Sphenostylis sternocarpa***

## INTRODUCTION
Herbaceous forage legumes are crucial to pasture and ruminant productivity in Sub-Saharan African countries where most grass species are of lower nutritional quality. However, the yields and nutritive contents of legumes might be affected when intercropped with grass species. Forage legumes improve animal performance when used as a supplement to poor-quality ruminant diets. *Mucuna pruriens* and *Sphenostylis sternocarpa* are lesser forage legumes rarely cultivated with grass species in mixed pasture-production systems for ruminants. Their seeds are protein sources for human and livestock consumption, but the foliage has not been adequately explored as ruminant fodder. The nitrogen-fixing ability of both legumes in the soil is beneficial to the companion grass species. Meanwhile, the ability of herbaceous forage legumes to withstand the aggressive growth habit of grass species in grass-legume pastures due to competition for growth resources is a matter of concern. A yield comparison of *Andropogon gayanus* intercropped with *Lablab purpureus* indicated a higher dry matter yield of *L. purpureus* than sole *A. gayanus* (Amole *et al*., 2015). Other similar studies (Gama *et al*., 2014) reported higher biomass yield of grass species intercropped with forage legumes than the companion legume species. *Megathyrsus maximus* (Guinea grass) is a grass species adapted to tropical climatic conditions and is highly acceptable to ruminants. Though they are low in crude protein content, it is a dominant grass species of most grazing lands in Nigeria. Based on this premise, we hypothesized that *Megathyrsus maximus* intercropped with *M. pruriens* and *S. sternocarpa* would affect the herbage yield and proximate composition of the companion forage legumes of the intercrops.

## MATERIALS AND METHODS

### *Location of the study, pasture establishment, proximate and statistical analyses*

The experiment was carried out at the Institute of Agricultural Research and Training, Moor Plantation, Ibadan, Oyo State, Nigeria (Latitude: 7º 22' 35.2" N and Longitude: 3º 50' 34.4" E). The weather conditions revealed an annual rainfall (1,538mm and 1,339mm), mean monthly temperature (23.08-31.83℃ and 27.25-35℃), and relative humidity (88.75% and 82.42%) for 2016 and 2017, respectively during the experimental period. The soil of the experimental plot was ploughed and harrowed. A total of 21 sub-plots (44 × 3 $m^2$ each) were measured out from the land and divided into three blocks. The blocks represented the replicates while the sub-plots in each block comprising T1= 75MM:25MP, T2= 50MM:50MP, T3= 75MM:25SS, T4= 50MM:50SS, T5= sole MP and T6= sole SS are the treatments. The preliminary particle and chemical soil analysis revealed sandy loam soil. Crown splits of *M. maximus* were planted at a spacing of 1 m × 1 m while seeds of *M. pruriens* and *S. sternocarpa* were sown at a spacing of 1 m × 1 m with two seeds per hole at about 2-3cm soil depth between rows of *M. maximus.* No fertilizer application was made. Weeding was done manually.

*Mucuna pruriens* and *Sphenostylis sternocarpa* from the intercrops and soles were harvested manually at ages of eight, ten and twelve weeks, respectively, after planting by cutting from the 1 $m^2$ quadrat thrown at random three times at a stubble height of 5cm from the ground level. Harvested forage legumes were weighed on the field immediately, using a 100 kg weighing balance to determine the biomass yield. Sub-samples of the same forage were taken and oven-dried for determination of dry matter yield. Values of yields obtained were expressed in tons/hectare. Oven-dried samples of *M. pruriens* and *S. sternocarpa* were analysed for dry matter, crude protein (N % x 6.25), ether extract, ash and crude fibre according to standard procedure (AOAC, 2005). A Randomised Complete Block Design (RCBD) was the design of the experiment. Data obtained were subjected to analysis of variance and differences among means were separated using Duncan's Multiple Range Test (Duncan, 1995) and significant differences were stated at $p< 0.05$.

## RESULTS AND DISCUSSION

The results presented in Figure 1 are the biomass and dry matter yields of forage legumes (*Mucuna pruriens* and *Sphenostylis sternocarpa*) intercropped with *Megathyrsus maximus.* Biomass and dry matter yields of *M. pruriens* and *S. sternocarpa* were different ($p<0.05$) across the treatments. Sole *M. pruriens* (T5) gave higher yields of biomass and dry matter than monoculture (T6) of *S. sternocarpa* and the legumes from the intercrops. Similarly, the *M. pruriens* and *S. sternocarpa* from the intercrops with *Megathyrsus maximus* at a ratio of 50:50, respectively, out yielded those intercropped at 75:25. Irrespective of the legume species, the yields of *M. pruriens* from the *M. maximus*-*M. pruriens* intercrop in 75:25 proportion was not different ($p>0.05$) from the yields of *S. sternocarpa* in *M. maximus*-*S. sternocarpa* intercrops at either a 75:25 or 50:50 ratio of mixtures. This further implies that the combination ratio of forage species, among other factors, in mixed grass-legume pastures is a determinant of herbage yield, which aligns with the findings of Amole *et al*. (2015).
The higher yields of *M. pruriens* as a sole and from the *M. maximus*-*M. pruriens* intercrops than *S. sternocarpa* could be attributed to its aggressive and vigorous growth pattern. This suggests that *M. pruriens* are compatible with *M. maximus*, and could compete favourably in the grass-legume intercropping system. The biomass and dry matter yields of the forage legumes (*M. pruriens* and *S. sternocarpa*) significantly ($p<0.05$) declined as ages at harvest advanced from 8 week to 12 week after planting (Figure 2). The trend of biomass yield indicated that forage legumes of 10 weeks harvests were more than other ages at harvests, though dry matter yield of forage legumes at the 8th and 10th weeks of harvest was not different ($p>0.05$). The high biomass yield of legumes at 10 weeks of harvest could be attributed to a shift of plant morphological changes directed towards increased vegetative growth. On the other hand, the trend of decline in yields associated with increased age at harvest could be ascribed to a decrease in leaf-to-vine ratio and an increasing rate of leaf fall or shattering.

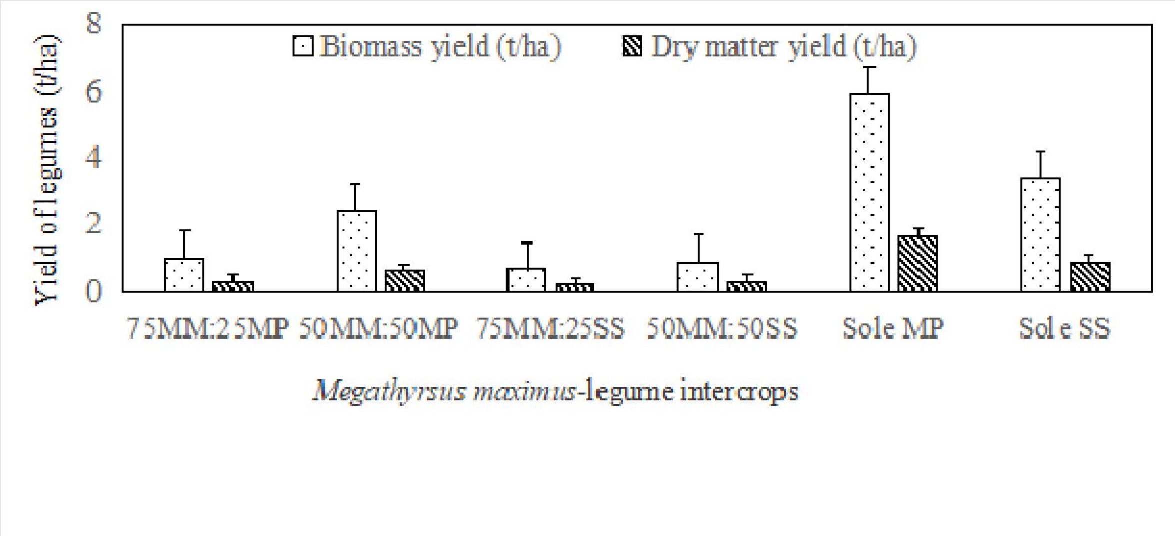


**Figure 1: Yields of *Mucuna pruriens* and *Sphenostylis sternocarpa* in *Megathyrsus maximus*-legume intercrops**

The combination ratio of *M. maximus* to *M. pruriens* or *S. sternocarpa*, as well as the interaction between ages at harvest and the ratio of grass-legume intercrops, affected the proximate composition of forage legumes (Table 1). Irrespective of the ratio of *M. maximus* intercropped with *M. pruriens or S. sternocarpa*, the dry matter (DM) content of the legumes was comparable along the treatments and varied from 25.39 to 30.09%.

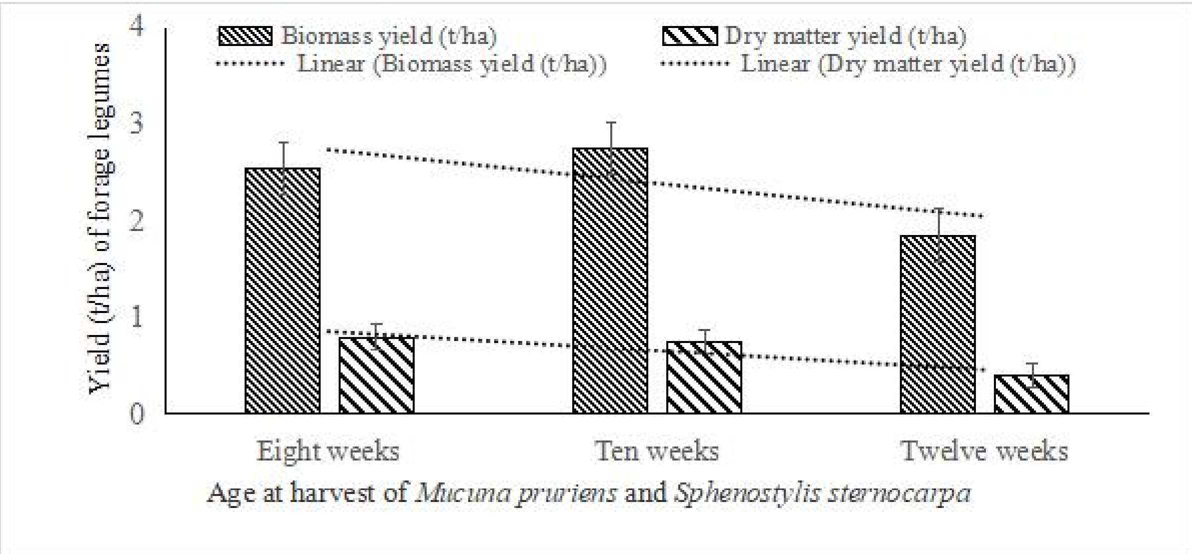


**Figure 2: Yields of *M. pruriens and S. sternocarpa* as influenced by age at harvest**

In the same vein, the crude protein (CP) content of the *M. pruriens* and *S. sternocarpa* from their respective *M. maximus*-legume intercrops (T1, T2, T3 and T4) was not different ($p<0.05$), except for the *S. sternocarpa* for T4, which was similar to the CP of *M. pruriens* from sole stands (T5). The range (20.75-21.82%) of CP in both forage legumes exceeded the CP requirement for sheep (NRC, 2007). This implied that the legumes were sufficiently rich in nitrogen, which benefits the companion grass species of the intercrops and could supply the required level of CP for optimal ruminal activities. The high CP could be the result of efficient N-fixation by the root nodules or possibly recycling and uptake of N from decomposed leaf fall by the forage legumes. Meanwhile, the low ether extract content in *M. pruriens* and *S. sternocarpa* suggest its inability to impair healthy ruminal activities.

**Table 1: Proximate composition (%) of *M. pruriens* and *S. Sternocarpa* as influenced by the ratio of mixtures and age at harvest**

| | Proximate composition | | | | |
|---|---|---|---|---|---|
| *M. maximus*-legume intercrop | Dry Matter | Crude Protein | Ash | Crude fibre | Ether extract |
| 75MM:25MP | 30.09$^{c}$ | 20.75$^{a}$ | 9.92$^{b}$ | 16.53$^{a}$ | 3.38$^{a}$ |
| 50MM:50MP | 27.67$^{b}$ | 20.84$^{a}$ | 9.61$^{a}$ | 16.42$^{a}$ | 3.53$^{c}$ |
| 75MM:25SS | 28.12$^{bc}$ | 20.89$^{a}$ | 9.71$^{a}$ | 16.07$^{a}$ | 3.66$^{de}$ |
| 50MM:50SS | 28.03$^{bc}$ | 21.82$^{c}$ | 10.03$^{b}$ | 16.78$^{b}$ | 3.65$^{d}$ |
| Sole MP | 26.92$^{ab}$ | 21.65$^{c}$ | 9.69$^{a}$ | 16.09$^{a}$ | 3.72$^{e}$ |
| Sole SS | 25.39$^{a}$ | 21.34$^{b}$ | 10.01$^{b}$ | 16.90$^{b}$ | 3.48$^{b}$ |
| *Probability level* | * | *** | *** | *** | *** |
| Age at harvest (A) | | | | | |
| 8-weeks | 22.19$^{a}$ | 22.18$^{c}$ | 9.82$^{b}$ | 15.84$^{a}$ | 3.76$^{c}$ |
| 10-weeks | 27.17$^{b}$ | 21.28$^{b}$ | 10.25$^{c}$ | 16.44$^{b}$ | 3.62$^{b}$ |
| 12-weeks | 33.76$^{c}$ | 20.18$^{a}$ | 9.42$^{a}$ | 17.11$^{c}$ | 3.33$^{a}$ |
| *Probability level* | *** | *** | *** | *** | *** |
| Interaction | | | | | |
| Age × Treatment | *** | *** | *** | *** | *** |

$^{abcde}$= Means along the same column with different superscripts are significantly different (p<0.05). MM= *Megathyrsus maximus*; MP= *Mucuna pruriens*; SS= *Sphenostylis sternocarpa*; Probability levels: *P<0.05, ***P<0.001

The crude fibre (CF) of *M. pruriens* from the sole and the intercrops was not different (p>0.05), likewise for *S. sternocarpa* from the sole (T6) and its intercrop with *M. maximus* (T4). However, the crude fibre content of *M. pruriens* and *S. sternocarpa* fell within the average recommended level of 16% CF for ruminants and higher than the CF values of four forage legumes reported by Ajayi (2012) in a similar study. The dry matter and crude fibre content of *M. pruriens* and *S. sternocarpa* increased with advanced harvest age, while it was the reverse for the crude protein, ash, and ether extract contents as harvest ages increased from week 8 to 12 week.

## CONCLUSION

Biomass and dry matter yields of *M. pruriens* planted as a sole or as intercrops with *Megathyrsus maximus* were higher than sole *S. sternocarpa* and its intercrop with *Megathyrsus maximus* and the harvest age of forages influenced both the yields and proximate content *of Mucuna pruriens* and *Sphenostylis sternocarpa.*

## REFERENCES


Ajayi, F. T. (2012). Dry matter yield, mineral contents and proximate composition of *Panicum maximum* (Jacq var Ntchisi) sown with forage legumes. *Nigerian Journal of Animal Production*, 39(1): 180-189.

Amole, T. A., Oduguwa, B. O., Onifade, O., Jolaosho, A. O., Amodu, J. T. and Arigbede, O. M. (2015). Effect of planting patterns and age at harvest of two cultivars of *Lablab purpureus* in *Andropogon gayanus* on agronomic characteristics and quality of grass/legume mixtures. *Pertanika Journal of Tropical Agricultural Science*, 38(3): 329-346.

Association of Official Analytical Chemists, AOAC. (2005). Official methods of analysis. 17th edition Arlington, VA, USA.

Gama, T. C. M., Volpe, E. and Lempp, B. (2014). Biomass accumulation and chemical composition of Massai grass intercropped with forage legumes on an integrated crop-livestock-forest system. *Revista Brasileira De Zootecnia,* 43, 279-288.

NRC (National Research Council). 2007. Nutrient requirements of small ruminants: Sheep, goats, cervids, and new world camelids. The National Academies Press, Washington, DC.