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Agronomic Performance and Nutrient Composition of *Andropogon Tectorum* as Influenced by Varied Inter-Row Spacing of *Lablab Purpureus* During a Minor Wet Season in the Derived Savannah Zone of Nigeria

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Abstract
Interplanting of *Lablab purpureus* at 0.0m, 2.5m, 5m and 7.5m inter row spacing on agronomic performance and nutrient composition of *Andropogon tectorum* during a minor wet season in the derived savannah zone of Nigeria was examined. High plant height value of 274.00cm was observed at 2.5m *Lablab purpureus* spacing, and was similar to values obtained at 5.0 and 7.5m (267.89cm and 265.56cm respectively) but significantly different ($P<0.05$) from the control (0.0m) treatment(229.99cm).
High *Andropogon tectorum* biomass value of 18,400kgha–1 was obtained at 2.5m legume inter-row spacing and the control give the least value of 9,800kg/ha.Dry matter contents of the forage were significantly different ($P<0.05$) except at 5.0m and 7.5m legume inter-row spacing that were similar($P>0.05$). High crude fibre was observed at the sole *Andropogon tectorum* control stands (31.20%) and decreasing with decrease in legume inter row spacing, with the least value(27.20%) obtained in 2.5m legume inter-row spacing. The Sodium, Calcium, Phosphorus, Magnesium, Iron, Manganese and Copper (Na, Ca, K, P, Mg Fe and Cu) contents of Andropogon tectorum were observed to be decreasing with increase inter- row spacing of the legume. Closer legume inter-row spacing had a positive influence ($P < 0.05$) on the nutrient content of *Andropogon tectorum*.
Keywords: Andropogon tectorum, inter-row spacing, Lablab purpureus

1. Introduction.

The benefits of legume –grass association can be expressed among others in terms of the enhanced dry matter yield, nitrogen content of herbage, animal intake of forage and animal productivity. Sustainable or organic farming pasture production is of great importance in developing countries especially Nigeria where the cost of inorganic fertilizer is among the highest in the world (Nigerian Tribune, 2007). Herbage yield during the raining season could be somewhat high, however it productivity declines sharply during the dry season when leaves are dry and coarse with low feeding value. Sabiiti (1992) reported that in the humid and sub-humid zones of Nigeria and Uganda, during the dry season, quality of grasses may decline up to 3% crude protein which is below the critical level of 7% crude protein recommended by Minson, (1990) thus limiting intake and digestibility with subsequent low animal production.
Dwivedi *et al.,* (1991) observed that a legume component in legume grass pasture improves the nitrogen status of the soil which subsequently increases biomass production and protein enrichment of the grass.
This study was designed to investigate the influence of varied inter – row spacing of grass–legume mixture on the agronomic performance and nutritive quality of *Andropogon tectorum*. Though various studies has been conducted on the effect of legume intercropping with grasses, however there were no report on the effects of *Lablab purpureus* on *Andropogon tectorum* during minor wet season in the derived savannah zone of Nigeria. The study will help to reveal more knowledge on the effect companion grass- legume combination and the availability of nutrients to animals during a water stress period.

2. Materials and Method

2.1 Site

The experiment was carried out at the Teaching and Research farm of Ladoke Akintola University of Technology, Ogbomoso (Latitude 80 N, Longitude 40 E) in the Derived Savannah zone of South-Western Nigeria. The climate was mostly influenced by the Northeast trade wind characterized with cold wind, with a dry effect starting from October to April. The prevailing wind during the dry season is locally known as Harmattan. The ambient temperature ranged between 210C - 330C with about 74% relative humidity all year round except in January. Monthly and daily rainfalls are characterized by high temporal and spatial variation which ranges from zero (0) to 338 mm and over 1673 mm per annum and usually occurs between April and October with a marked dry season from late October to early April of the following year.(BATC 2005)
The wet season can be divided into main wet (April to August) and minor wet (Sept-October) seasons based on

the percentage of the total rainfall in these periods.

2.2 Land Preparartion and Experimental Design

The land was mechanically ploughed and harrowed before plots layouts. There were four treatments namely 0, 2.5m, 5m and 7.5m inter-row spacing of the legume (*Lablab purpureus*). The experiment was a randomized complete block design. Three blocks were established to cater for the topography of the experiment site and each block was divided into four plots with each treatment per plot. The treatments were replicated thrice and each plot size measured 45m x 15m.Initial Soil samplings from about 40 random spots were collected at 0- 15cm depth with the aid of soil augar before planting, bulked, air dried and kept till required for chemical analysis.

*Lablab purpureus (*I. 147) seeds were procured from the International Institute of Tropical Agriculture, Ibadan. The seeds of *Lablab purpureus* were ready for planting on arrival. The legume was planted in rows within the plots at spacing of 0 (control), 2.5m, 5.0m and 7.5m intervals. Two weeks post legume sowing, tillers of *Andropogon tectorum* were interplanted at a spacing of 0.83m between rows and 0.5m along the rows given 2 rows, 5 rows and 8 rows of *Andropogon tectorum,* respectively, in between 2.5m, 5.0m and 7.5 spacing of *Lablab purpureus* .

The plots were free of weeds throughout the period of study. The weeds on removal were left in the plots to decay so as to return nutrients back to the soil. Dead stands of *Andropogon tectorum* or dead rows of legume were replaced accordingly in the year of establishment.

2.3 Data Collection.

Twelve (12) weeks after planting in the first year and 12 weeks after cut back and regrowth in subsequent years, up to the third year, height and leaf length of *Andropogon tectorum* were measured randomly within each treatment with the aid of a field tape, also the number of tillers and number of leaves were counted. Biomass yield was determined by manually harvesting of the total plants within each replicate in a 1m2 quadrant. The proximate composition of the forage and its mineral contents were determined at the end of the three-year experimental period.

2.4 Soil Analysis

Prior to the establishment of the plants, soil samples were randomly collected and analyzed as described by A.E.S. (1998). Also at week 12 after establishment (and cut back in subsequent years) (table 1) soil samples for each treatment were randomly taken with the aid of soil augar and analysed as described by (A.E.S. 1998).

2.5 Proximate and Elemental Analysis

Grass representative samples were taken with the aid of cutlass and oven dried at 60 0 C for 48 hours to determine dry matter content. They were later analyzed for DM, CP, CF, EE ASH and NFE using the AOAC (2000) methods. Mineral elements were also analyzed according to the AOAC (2000) method. The atomic absorption spectrometer was used to determine Ca, K and Fe. Phosphorus (P) was determined using the colorimetric molybdenum-blue procedure (Murphy and Riley., 1962).

The experimental data obtained were subjected to analysis of variance, and means were separated using Duncan multiple range F-test of the SAS (1988) options.

3.0 Results and Discussion

The effect of varying inter-row spacing of *Lablab purpureus* on the agronomic performance of *Andropogon tectorum* is presented in Table2. Interplanting of *Lablab purpureus* had a significantly ($P<0.05$) positive effect on the final height of *Andropogon tectorum* among the treatments except in control group which gave a lower value.

The highest grass height recorded was in 2.5m *Lablab purpureus* spacing, legumes are known to fix nitrogen into the soil and thus aid the growth of companion grasses. The result was in harmony with the observation of Tawarali, (1991) who reported an increase in grass yield interplanted with legume.

The highest leaf length value was observed on plots subjected to 2.5m Lablab inter row spacing and it was observed to be decreasing ($P<0.05$) with increase in Lablab inter-row spacing with the least value obtained in the control treatment.

The variation perhaps was due to the effect of fixed nitrogen on the grass species. More nitrogen could have been fixed by closer spacing of the leguminous crops. Volenec and Nelson (1983) reported that improved soil nitrogen increased leaf elongation rate and size in plants.

The number of tillers produced by *Andropogon tectorum* also followed the same trend and was observed to be significantly different from each other, with the

2.5m lablab inter-row spacing given the highest value. Brown and Ashley (1974) reported that increased nitrogen availability increased tillering. Availability of nitrogen to grasses stimulates tiller development and increases leaf size.

The number of leaves produced by *Andropogon tectorum* was observed to be higher in 2.5m legume inter row spacing though similar to 5.0m spacing. Gastal *et al.* (1992)

observed that though nitrogen greatly increases the rate of leaf extension, it is only loosely related to the rate of its appearance.

The highest biomass yield was obtained on 2.5m legume inter-row spacing, with the least value recorded on the control. The results obtained in this study are consistent with the observation of Dwivedi *et al.* (1991) that legume components improved the nitrogen status of the soil and biomass production. The similarities in the Biomass yield at 5.0m and 7.5m legume inter row spacing could be as a result of the restorative effects of legumes over the years which normally leads to changes in the soil chemical properties (Table 1). This had a positive effect on the crude protein of *Andropogon tectorum* (Fig 1).

Figure 1 shows the crude protein content of Andropogon tectorum interplanted at various spacing with *Lablab purpureus*. The highest crude protein content of the grass was observed in 2.5m legume inter row spacing and the least in sole *Andropogon tectorum* stands. The high crude protein observed in 2.5m legume inter-row spacing could be attributed to the influence of the legume and the legume inter-row spacing which allowed for greater percentage of nitrogen fixation. Reynolds (1992) observed that interplanting of grass with legume at a close spacing transfer more nitrogen in legume grass mixture than the amount fixed by other distant legumes. It also agrees with the reports that grass chemical compositions are affected by interaction of legume grass proportions, (Hu and Jones 2001).

The Dry matter content of the forage were significantly different($P<0.05$) from each other except with 5.0m and 7.5m legume inter-row spacing that were similar($P>0.05$). The high dry matter values recorded for all the treatment could be

ascribed to the effect of water stress at season of sampling. The forage samples were carried out during the dry season when moisture content in forage is usually low.

The highest crude fibre content of the grass was observed in the sole *Andropogon tectorum* stands. It was however observed to be decreasing with decrease in legume inter row spacing, with the least value obtained in 2.5m legume inter-row spacing, though it was not significantly different from 5.0m legume inter-row spacing. The high crude fibre could be due to effect of water stress on the *Andropogon tectorum*. Plant grown in hot, dry environments are known to develop thick cells walls (Cutter *et al.,* 1977), thick cuticle, and highly lignified tissue (Levitt, 1980). Increases in cellulose or hemicelluloses and lignin concentration of forage had been reported by Wilson (1983) and Halmin *et al.,* (1989) to be due to increase in water stress experienced by the plants which could have resulted in increased crude fibre in the plants.

The values of ether extract recorded were almost similar for all the legume-based *Andropogon tectorum* stands, but they differed significantly when compared with that of the sole *Andropogon tectorum* stands. This shows that the legume has a positive influence on fat content of *Andropogon tectorum* and can be attributed to the facilitative effects of decayed leaves of legumes on the nutritional components of the grass.

There was significant difference ($P<0.05$) in the ash contents when the treatments were compared. The highest value was observed on the 2.5m legume inter- row spacing and it decreases with increase in the legume inter-row spacing. The least value was recorded on the sole *Andropogon tectorum* stands. Fisher and Baker (1996) observed that leguminous species posses higher mineral content than grass species. Legumes via their rooting ability have the potential to explore deeper soil layer to tap available mineral elements which the companion grass can benefit.

The roots and leaves of these leguminous plants also under go senescent and they decay thus returning the mineral back to the soil for utilization by their companion grasses. The effect of legume inter-row spacing on the nitrogen free extract of the *Andropogon tectorum* was not significant ($P > 0.05$).

Table 3 shows the effect of varying interrow spacing of *Lablab purpureus* on the mineral composition of *Andropogon tectorum* during minor wet season. The Na, Ca, K, P, Mg Fe and Cu contents of *Andropogon tectorum* decreased with increased inter-row spacing of legume. It was observed that closer planting geometry of legume-grass ratio results into higher content of these mineral in the *Andropogon tectorum* grass, however copper concentration of *Andropogon tectorum* at 7.5m inter row spacing and the sole *Andropogon tectorum* stands was similar. This observations are in harmony with the reports of Miles and Manson, (2000) who reported higher mineral content in forage legumes than grasses. The Zn concentration in sole *Andropogon tectorum* stand was highest and it decreased with decreased legume inter-row spacing. The high value obtained generally in legume based *Andropogon tectorum* is in agreement with the observations of Ezenwa and Aken'Ova (1998) that legumes do contribute significantly to the nutritive value of grass species in legume- grass mixture.

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Table 1: Chemical compositions of experimental site soil prior and post experiment

			Lablab purpureus+ grass		
Chemical Properties	**Initial**	**control**	**2.5m**	**5.0m**	**7.5m**
PH	6.0	6.10	6.2	6.3	6.30
%N	0.08	0.085	0.16	0.12	0.095
%O.C	0.85	0.80	1.4	0.93	0.8
%O.M	1.24	1.19	1.66	1.64	1.38
Na cmkg-1	0.18	0.18	0.28	0.24	0.22
Ca cmkg-1	2.50	2.55	3.27	3.10	3.03
K cmkg-1	0.19	0.20	0.43	0.35	0.25
P mgkg-1	9.30	9.21	6.38	7.45	8.97
Mg cmkg-	0.55	0.5	1.22	1.10	0.9
Zn cmkg-1	2.25	2.10	1.30	2.00	2.10
Fe cmkg-1	0.95	1.10	1.80	1.40	1.20
Mn cmkg-	0.15	0.10	0.40	0.40	0.20
Cu cmkg-1	1.25	1.2	1.4	1.35	1.3

Table 2
Effect of varying inter-row spacing of *Lablab purpureus* on the agronomic performance of *Andropogon tectorum* during a minor wet season over a 3year period

Parameters at 12WAP	control	2.5m	5.0m	7.5m	S.E
		Legume inter-row spacing			
Final height(cm)	229.99^{b}	274.00^{a}	267.89^{a}	265.56^{a}	5.37
Leaf length(cm)	46.00^{d}	56.89^{a}	54.33^{b}	51.22^{c}	1.24
Av. number of leaves	11.66^{c}	17.00^{a}	16.00^{a}	14.57^{b}	0.62
No of tillers	21.11^{d}	30.49^{a}	28.5^{b}	25.15^{c}	1.08
Biomass yield kg/lm2	0.98^{c}	1.84^{a}	1.68^{b}	1.59^{b}	0.09
Biomass yield kgha-1	9,800^{c}	18,.400^{a}	16,800^{b}	15,900^{b}	0.09

^{abcd}Means with different superscripts along a row are significantly different (P<0.05).

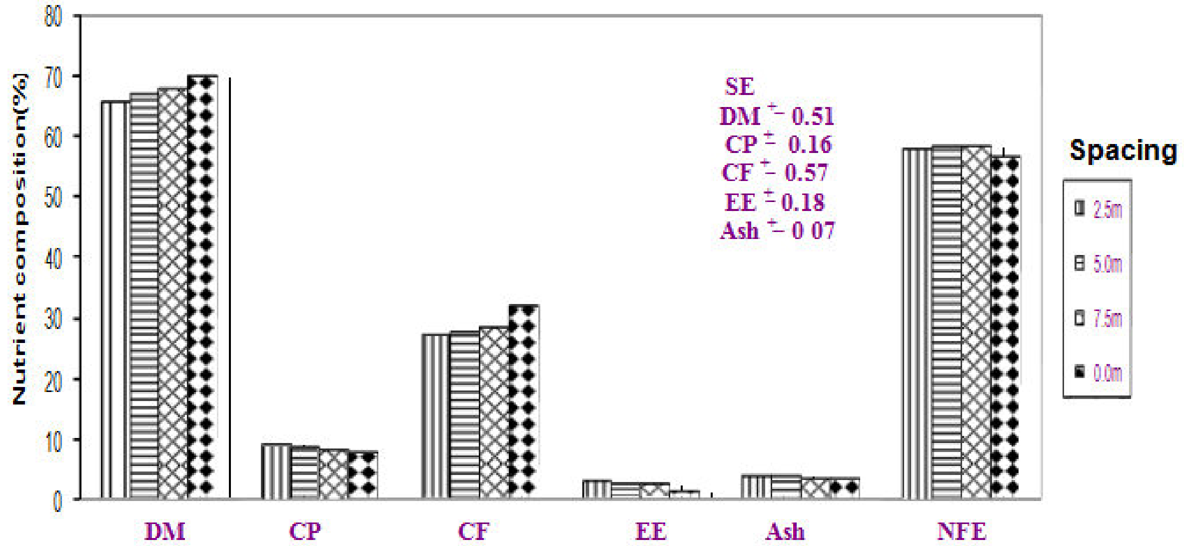

Fig 1: Spacing effects of *Lablab purpureus* on proximate composition of *Andropogon tectorum* at 12weeks old, over a 3year period.

Table 3
Effect of varying inter-row spacing of *Lablab purpureus* on the mineral composition of *Andropogon tectorum* during a minor wet season over a 3year period

Parameters at 12WAP	Control	2.5m	5.0	7.5m	S.E
		Legume inter row spacing			
Na g/kg	0.057^{d}	0.074^{a}	0.072^{b}	0.066^{c}	0.003
Ca g/kg	0.11^{c}	0.17^{a}	0.16^{ab}	0.14^{b}	0.005
K g/kg	0.13^{d}	0.27^{a}	0.25^{b}	0.22^{c}	0.014
P g/kg	0.08^{d}	0.155^{a}	0.12^{b}	0.10^{c}	0.009
Mg g/kg	0.043^{d}	0.095^{a}	0.075^{b}	0.060^{c}	0.006
Zn mg/kg	15.80^{a}	10.39^{d}	12.99^{c}	14.96^{b}	0.63
Fe mg/kg	26.42^{d}	30.30^{a}	28.94^{b}	27.68^{c}	0.44
Mn mg/kg	28.15^{d}	31.27^{a}	29.66^{b}	28.74^{c}	0.36
Cu mg/kg	3.85^{c}	5.14^{a}	4.70^{b}	4. 13^{c}	0.15

^{abcd}Means with different superscripts along a row are significantly different (P<0.05).

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