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Three cultivars of *Lablab purpureus* foliage in Igbo-Ora, Oyo State, Nigeria are nutritive

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Abstract

Lablab purpureus is a perennial legume, is a valuable feed resource for livestock production. The foliage of three cultivars of *Lablab purpureus* (Tln-43, Tln-49 and Tln-51) were evaluated for their proximate, minerals compositions and anti- nutritional factors in a completely randomized block design experiment. *Results showed significant differences among cultivars in (P<0.05) crude protein (16.97%), ether extract (5.9%EE) crude fat (27.37%CF), ash (9.98%) and dry matter (72.44%) contents. Similarly, minerals contents of phosphorus (0.37%P),* potassium 0.89%K), calcium (0.26%Ca), magnesium (0.29%Mg), iron (192.60mg/kg Fe), and Zinc (55.28mg/kg Zn) *were influenced by cultivars* of *Lablab purpureus*. *The values of anti-nutritional factors* in the three cultivars of *Lablab purpureus* leaves *ranged from 0.44 to 0.73% for Saponin, Oxalate (0.40-0.53%), Phytate(0.62 to 0.85%), tannin(0.04-0.06%), trypsin inhibitor (20.24-21.78mg/g)and HCN (1.65-2.37mg/g). It was concluded from this study that, nutrient contents, anti-nutrient factors as well as mineral contents were influenced by cultivars of purpureus,* though their anti-nutrients contents cannot poses any deleterious effect to ruminant animal's feed and feeding regime.

Keywords: Proximate, Minerals compositions, Anti-nutritional contents, *Lablab purpureus* leaves.

Introduction

Lablab purpureus is a climbing annual or short-live perennial with long stems. It is a valuable feed resource for livestock production. It is a leguminous plant that can be grazed by both large and small ruminant animals (Muhammed *et al*., 2004). Its hay is palatable as well as being used for making good silage. Forages are known to have an important role in the nutrition of ruminant animals in terms of providing energy, protein and mineral element for chewing and rumination (Ahmad *et al*., 2000). The importance is under scored by the fact that a major constraint to livestock production in tropical Africa is the scarcity and fluctuating quality of year round forage supply (Ajayi *et al*., 2005).

Furthermore, most available ruminant feeds and feedstuff during the dry season have been described as fibrous, resulting in low digestibility and poor livestock production (Richard *et al*., 1994). The use of forage legume such as lablab as feed supplements has been shown to enhance the intake of poor roughages, improve growth rates and increase production efficiency in ruminants (Orden *et al*., 2000). Suitable legumes species have the potential to ameliorate feed constraints, especially for cattle and other ruminants, during the dry season, through their higher nutritive value relative to natural fallows (Minson, 1990). Among the many introduced forage legumes that have so far been evaluated in Nigeria, lablab has been reported to be a promising crop for the Northern guinea savannah (Thomas and Sumberg, 1995. Wuafor and Odunze, 1999). The foliage analysis result suggests that it had high protein content (15-30%) as well as high levels of lysine and digestibility (Valenzuela and Smith, 2002). The hay is high in crude protein (>17%). Ash (8%) and digestibility (>54%) (Murungweni *et al*., 2004).

Lablab purpureus plays an important role in the development of drought resistance mechanisms (Subbarao *et al*., 1995). These mechanisms include the ability of lablab to grow deep tap roots enabling the plant to reach deep residual soil moisture (Smart 1996). Lablab was considered to cope better with drought conditions compared to some of the more widely grown legumes such as common bean(*Phaseolus vulgaris*) or cowpea(*Vigna unguiculata*), moreover lablab is a traditional food and fodder crops in Africa and offer great potential for small holder farmer systems in the semi-arid region.(Karachi, 1997 and Osman, 2007).

Among the introduced forage legumes that have so far been evaluated in Nigeria, lablab have been reported to be a promising crop for its characteristics of possessing high protein content, high level of lysine and digestibility. Also it enhances intake of poor quality roughages, improves growth rate, and also increase production efficiency in ruminants. This study is to access different cultivars of *Lablab purpureus* leaves to know the cultivar that possess the best characteristics among others. There is need for farmers to identify the most nutritive and the one with less anti nutrient factors in other to be useful for ruminant animals as feed and the one that is considered most preferred among the hosted cultivars.

Materials and methods

Experimental site

The experiment was carried out at Teaching and Research farm of Oyo State College of Agriculture and Technology, Igboora which is located within $7^0 15$ North and $3^0 30$ East of the equator with an average annual temperature 27^0 (Sanusi, 2011).

Experimental layout and management practices

The area of land used was $144m^2$. The land was cleared, stumped and leveled manually to obtain a clean seed bed. The experimental plots were laid in randomized complete block design. Each experimental plot measured 3m x3m with 1m gap between plots. There were three treatments which consist of three (3) different cultivars of *Lablab purpureus* were Tln-43, Tln-49 and Tln-51 respectively. Each treatment was replicated thrice and seeds of three of *Lablab purpureus* were procured from the International Institute of Tropical Agriculture (IITA), Ibadan, Oyo State, Nigeria. Treated seed of *Lablab purpureus* were planted at rated of 2 seed per hole with a spacing of 50cmx50cm. Before flowering 10 weeks age the herbage sample was taken from three replications pooled and mixed, one representative sub sample was taken per accession and saved pending chemical analysis after drying.

Proximate composition

The air-dried leaves were ground into fine powder. About 10.0 g of the grounded leaves was exhaustively processed for various parameters according to the Association of Official Analytical Chemists methods; (AOAC, 1990; AOCS, 2000). The proximate analysis (fats, crude protein, moisture, crude fiber and ash) of the leaves were determined using AOAC methods. Using weight difference, moisture and ash were obtained. The fiber content was estimated from the loss in weight of crucible and its content on ignition. The nitrogen value, which is the precursor for protein of a substance, was determined by micro kjeldah method, involving digestion, distillation and finally titration of the sample (AOCS, 2000). The nitrogen value was converted to protein by multiplying with a factor of 6.25. The determination of crude lipids content of the samples was done using soxhlet type of direct solvent extraction method. The solvent used was petroleum ether (boiling range 40-60^{0}C). The result of proximate value was all estimated as percentage (AOAC, 1990; AOCS, 2000).

Mineral analysis

The mineral elements were analyzed using the method of Walinga *et al.* (1989); the elements in the samples were brought into solution by wet digestion technique using a mixture of concentrated nitric, prechloric and sulphuric acid. In the ratio 9:2:1 respectively. K, Fe, Zn, Ca, and Mg were determined by atomic absorption spectrometer and phosphorus was determined by using Vanadomolybdate Calorimetric Method (AOAC, 1995).

Anti-nutritional factor

Oxalate was determined by the method of Krishna and Ranjina, (1980) while phytate was determined by AOAC, (1990) method. The tannin was determined by the procedure of (Polshettiwar *et al.*, 2007). Trypsin inhibitor activity was determined according to the method of Kakade *et al.* *(*1974).

Statistical analysis

Data obtained were subjected to analysis of variance using General linear model of SAS, 2000. The significant means were separated using Duncan multiple range test.

Results and discussions

Results

Table 1 shows the proximate composition of three cultivars of *Lablab purpureus* foliage. There were significant differences ($P<0.05$) among the three accessions in proximate composition of their leaves. The three cultivars of *Lablab purpureus* were Tln-43, Tln-49 and Tln-51 respectively. The Crude protein (CP %) contents of three cultivars of *Lablab purpureus* ranged from Tln-51 (14.88%) to Tln-43 (16.97%). The concentration of Ether extract (EE %) ranged from 2.65%-3.09% and the highest value for ether extract was noted in Tln-49 (3.09%) leaves while the least was observed in Tln-51(2.65%). Crude fibre (CF %) was varied among the three cultivars of *Lablab purpureus* and it ranged from 17.18% to 27.35%. Highest crude fibre content was observed in Tln-51 (27.35%) and the least value was noted in Tln-49 (17.18%).The concentration of Dry matter content among the three cultivars of *Lablab purpureus* varied from 66.90% to 72.44%. The highest value of dry matter was noted in Tln-51 (72.44%) while least value was obtained in Tln-49 (66.90%). There was no difference among cultivars with regards to ash content, but it was numerically higher in Tln-51 (9.95%).

Table 1: Proximate composition of three cultivars of *Lablab purpureus* leaves

Parameters	CP	EE	CF	Ash	DM
Lablab purpureus (Tln-49)	15.67^b	3.09^a	17.18^b	9.87	66.90^c
Lablab purpureus (Tln-51)	14.88^c	2.65^b	27.35^a	9.95	72.44^a
Lablab purpureus (Tln-43)	16.97^a	3.07^a	21.69^c	9.65	71.10^b
SEM	0.18	0.04	0.73	0.12	0.45

^{abc} Means with different superscripts along the same row are significant ($P< 0.05$) different

Results of the mineral contents of the cultivars are presented in Table 2. Significant (P<0.05) difference were observed among the three cultivars in terms of mineral contents. The concentration of phosphorus (P %) among the three cultivars of *Lablab purpureus* leaves was the same numerically (0.37%). The concentration of potassium (K %) contents varied and their values ranged from 0.86% to 0.89% among the three cultivars of Tln-49, Tln-51, and Tln-43 respectively. The highest value of potassium was noted in Tln-43 (0.89%) while the least value was noted in Tln-51 (0.86%). Calcium contents varied among the three cultivars from 0.24% to 0.26%. Highest Calcium content was observed in Tln-49 (0.26%) while least value was noted in Tln-43 (0.24%). The highest values for iron (192.60mg/kg) and zinc (55.28mg/kg) were obtained in Tln-49 followed by Tln-43 on iron (191.60mg/kg) and zinc (53.58mg/kg), the least value obtained in Tln-51 for iron (190.80mg/kg) and zinc (52.73mg/kg). The concentration of magnesium (Mg %) among the cultivars of *Lablab purpureus* varied from 0.28% to 0.29%. Comparable value (0.29%) was observed in both Tln-43 and Tln-51.

Table 2: mineral composition of three cultivars of *Lablab purpureus* foliage

Parameters	P%	K%	Ca%	Mg%	Fe (mg/kg)	Zn (mg/kg)
Lablab purpureus (Tln-49)	0.37	0.88^{b}	0.26^{a}	0.28^{b}	192.60^{a}	55.28^{a}
Lablab purpureus (Tln-51)	0.37	0.86^{c}	0.25^{b}	0.29^{a}	190.80^{c}	52.73^{c}
Lablab purpureus (Tln-43)	0.37	0.89^{a}	0.24^{c}	0.29^{a}	191.60^{b}	53.58^{b}
SEM	0.001	0.002	0.002	0.001	0.002	0.12

[abc] Means with different superscripts along the same row are significant (P< 0.05) different

Table 3: shows the results of anti-nutrient contents present in cultivars of *Lablab purpureus* leaves. The saponin level of the cultivars ranged from 0.44% to 0.73%. Highest saponin content (0.73%) was noted in Tln-51 followed by Tln-43 (0.69%) and least was observed in Tln-49 (0.44%). Oxalate level in Tln-51 (0.53%) was the highest compared to Tln-43 (0.52%) and Tln-49 (0.40%). The phytate level ranged from 0.62% to 0.85%. Highest phytate content was observed in Tln-51 (0.85%) and the lowest value in Tln-49 (0.62%). The concentrate of tannin among the cultivars varied from 0.04% to 0.06%. Highest value was observed in Tln-51 (0.06%) while the least value was noted in Tln-49 (0.04%). The trypsin inhibitor varied among the three cultivars of *Lablab purpureus* from 20.24mg/kg to 21.78mg/g with the highest trypsin inhibitor content noted in Tln-51 (21.78mg/g). Lowest value of trypsin inhibitor was however observed in Tln-49 (20.24mg/g).The HCN content of the three cultivars examined ranged from 1.65mg/g to 2.37mg/g. Highest HCN content was observed in Tln-51 (2.37mg/g) and least value noted in Tln-49 (1.65mg/g).

Table 3: Anti -Nutrient Contents Present in Three Accessions of *Lablab purpureus*

Parameters	Saponin (%)	Oxalate (%)	Phytate (%)	Tannin (%)	Trypsin Inhibitor (mg/g)	HCN (mg/kg)
Lablab purpureus (Tln-49)	0.44^{c}	0. 40^{c}	0.62^{c}	0.04^{c}	20.24^{c}	1.65^{c}
Lablab purpureus (Tln-51)	0.73^{a}	0.53^{a}	0.85^{a}	0.06^{a}	21.78^{a}	2.37^{a}
Lablab purpureus (Tln-43)	0.69^{b}	0.52^{b}	0.84^{b}	0.05^{b}	21.69^{b}	1.74^{b}
SEM	0.02	0.01	0.02	0.001	0.02	0.19

[abc] Means with different superscripts along the same row are significant (P< 0.05) different

Discussion

Proximate composition of three cultivars of Lablab purpureus foliage

The percentage crude protein ranged (14.88-16.97%) was recorded for three cultivars of *Lablab purpureus*. The CP contents of all the cultivars were high and well above the 15% level considered adequate for lactating and growth in dairy cows (Omokanye, 2001). The higher values of crude protein recorded for the three cultivars of *Lablab purpureus* in the present study was higher than 7% CP requirement for ruminant animals which will provide ammonia requirement by the rumen micro-organism to support optimum microbial activity. The foliage could serve as potential protein supplement and enhance the feed intake and utilization of low quality grass and fibrous crop residues by ruminants. The importance of protein to animal and human health cannot be over emphasized; therefore *Lablab purpureus* foliage could be used as feed protein supplement. Ether extract contents of three cultivars of *Lablab purpureus* ranged (2.65-3.09%). The value recorded for ether extract in the present study fell below 4.10% reported by Alalade *et al.*, (2016) for *Psophocarpus tetragonolobus* leaves. The Ether extract contents of all cultivars fell within the range of (4-10%) EE reported by Campbell *et al.*, (2006). The value of ether extract in the all cultivars was an indicator of higher energy level in the cultivars for the animal (Babayemi and Bamikole, 2006) and thus, this was a major form of energy stored in plant which will be utilized by animals for body maintenance and production. The crude fiber content of three cultivars of *Lablab purpureus* foliage ranged from (17.18-25.35%) which was higher compared with 14.80% of *Mucunautilis* leaves reported by Ujowundu *et al.,* (2010) but below (23.8%) for *Stylosanthes hamata* (Akinlade *et al.,* 2004). The crude fiber contents of all cultivars fell within the (15-20%) recommended for improved intake and production in finishing ruminant (Buxton, 1996). The crude fiber content value of all cultivars of *Lablab purpureus* leaves reported will aid digestion and absorption of water in favour of animals (Ayoola and Adeyeye, 2000). The highest value of 9.95% ash content in the cultivars of *Lablab purpureus* was above (5.08%) recorded for *Psophocarpus tetragonolobus* leaves (Alalade *et al.*, 2016) and also higher than (3.70%) reported for *Mucuna utilis* leaves (Ujuwund u*et al.*, 2010).

Mineral composition of three cultivars of Lablab purpureus foliage

The mineral contents of all cultivars gave the idea of possibility using the plant as a complete diet for ruminant animals. The phosphorus content of all cultivars of *Lablab purpureus* leaves (0.38%) were higher compared to NRC recommended 0.15% for phosphorus (NRC, 1985). The level of phosphorus in all cultivars of *Lablab purpureus* leaves was consistently above the 0.2% level which could satisfy livestock dietary maintenance requirement (NRC, 1985). Phosphorus plays an important role in carbohydrate, lipid, and amino acid and metabolism. Phosphorus is required for blood coagulation (Thromboplastin) satisfactory bone calcification, optimum grow rate and optimum utilization of both calcium and phosphorus (Underwood, 1981).

The calcium (0.26%) content of all cultivars of *Lablab purpureus* leaves was higher than (0.09%) observed in *Canavaliaensiformis* leaves by Akinlade *et al.* (2007). The Ca values found in this study were considered adequate for the optimum performance of ruminants. The value of Calcium of the *Lablab purpureus* leaves would not meet the theoretical

Calcium requirement of 0.30% recommended in diet ruminants (ARC, 1980) Calcium helps in the regulation of muscle and in the development of kid weaners and foetus in bones and teeth development (Margaret and Vickery, 1997).

The magnesium least content of three cultivars of *Lablab purpureus* leaves (0.28%) was higher than 0.20% reported for *Canavaliaensiformis* leaves by Akinlade *et al.* (2007). The higher Mg level (0.29%) found in this study was higher than 0.12% to 0.20% of the requirement of the ruminant's diet suggested by (NRC, 1985). Magnesium is an important mineral element in connection with its role in circulatory disease such as ischaemic heart disease and calcium metabolism (Ishida *et al.*, 2000).

The Iron content of all cultivars of *Lablab purpureus* ranged (190.80-192.60 mg/kg) and was higher compared to (181.65 mg/kg) reported for Iron content of *Psophocarpus tetragonolobus* leaves (Alalade *et al.*, 2016). Accessions of *Lablab purpureus* leaves content in the present study was above (50 mg/kg) considered sufficient for the requirement of ruminant animals for optimal performance and also above the critical levels of Fe in animal tissue (30-50 mg/kg) (Khan *et al.*, 2005). This implies that foliage of these cultivars were good sources of dietary iron. Iron is said to be an important element in the diets of pregnant animals, nursing animals, infant and other related disease (Anonymous, 1980).

The concentration of zinc in the plant forage samples was found to be (53.40-54.76 mg/kg) and was higher than (44.3 mg/kg) recorded for *Clitoria ternatea* leaves by Swati and Varsha (2014). It has been suggested that 30mg/kg zinc is a critical dietary level although it has been recommended that concentration of 12-20 mg/kg are adequate for growing ruminants (Melaku *et al.*, 2005). Zinc is said to be an essential trace element for protein and nucleic acid synthesis and normal body development during period of rapid growth such as infancy and recovery from illness (Barry, 1984).

Anti-nutrient content present in three cultivars of Lablab purpureus leaves

This tannin level was much lower than the level of 5% at which goats may reject feed (McLeod, 1974). Tannin at this level protects liable plant protein in the rumen and consequently increases the supply of high quality protein in to the duodenum (McLeod, 1974). However, when forage legumes contain high level of condensed tannins, intake and apparent digestion of protein and carbohydrate are depressed (Bamikole *et al.*, 2004).

Oxalate in this present study was low (0.40-0.53%). It was been reported that 20g/kg oxalate can be lethal to chicken (Acamovic *et al.*, 2004). Oxalate has been shown to depleted the calcium reserve, but these browse species were found to contain responsibly amount of calcium, magnesium and phosphorus (Akinsoyinu and Onwuka, 1988). Calcium and carbon are also released from hydrolysis of calcium oxalate some of which will be either absorbed or excreted by the ruminant animals. With calcium absorption rate of ruminant put at 31% (Haenlein, 1987) and P at 4% absorption (Adeloye and Akinsoyinu, 1985) reasonable amount of the calcium and phosphorus intake will be lost via feaces and urine to the soil.

The saponin value ranged from 0.44%-0.73%. Feedstuffs containing saponin had been shown to be defaunating agents (Teferedegne, 2000) and capable of reducing methane production (Babayemi *et al.*, 2004b). Cheeke (1971) reported that saponin have effect on erythrocyte haemlysis, reduction of blood and liver cholesterol, depression of growth rate, bloat (ruminant) inhibition of smooth muscle activity, enzyme inhibition and reduction in nutrient absorption. Saponin have been reported to alter cell wall permeability and therefore to produce some toxic effect when ingested (Belmar *et al*., 1999).

The phytate contents of *Lablab purpureus* is shown in table 3. The values range was (0.62-0.85%). However, the value was lower than 25mg/100g reported by Amata (2010) for leaves of *Myrianthus arboreus*. The negative effect of phytate in nutrition is the chelating of certain essential element such as Ca, Fe, Mg and Zinc and this contribute to mineral deficiency in people who relies on some food rich in phytate for their mineral intake (Hurrell, 2003). Nevertheless, phytate are considered as phytonutrient providing an antioxidant effect and their mineral binding properties prevent colon cancer by reducing oxidative stress in the lumen of the intestinal tract (Volcanic and Shamsuddin, 2003).

The HCN contents of the browse species examined were equally low. The HCN ranged from 1.65mg/kg-2.37 mg/kg. The lethal dose of HCN for cattle and sheep is 2.0-4.0mg per kg body weight. The lethal dose for cyanogens would be 10-20 time greater because the HCN comprised 5-10% of their molecular weight (Conn, 1979). H0wever, the quality of HCN produced by most of these species is too low to pose major animal health problem (Kumar and D, Mello, 1998). Animals suffering from cyanide toxicity must be immediately treated by injecting of suitable dose of sodium nitrate and sodium thiosulphate (Kumar, 2003). Generally, only plants that produce more than 20mg HCN/100kg fresh weight are considered deleterious (Everest, 1981).

The values of trypsin inhibitor content were 20.24-21.78mg/g for *Lablab purpureus* leaves. Trypsin inhibitor is protease inhibitor occurring in raw legume seeds. Protease inhibitors are the most commonly encountered class of anti-nutritional factors of plant origin. This trypsin inhibitor has been reported to be partly responsible for the growth retarding property of legumes. The retardation has been attributed to inhibition protein digestion but there is evidence of pancreatic hyperactivity, resulting in increased production of trypsin with consequent loss of lysine and methionine (Donald, 1995). Trypsin inhibitor has been implicated in reducing digestibility of protein and in pancreatic hypertrophy (Liner, 1976).

Conclusion

The study showed that *Lablab purpureus* foliage had better nutrient values due to high content of protein and minerals with relatively low levels of anti-nutrient factors which were below the lethal point in ruminant animals. *Lablab purpureus* foliage can be recommended as a reliable leguminous plant supplement for ruminant animals, thereby alleviating the crisis of poor quality feed and feeding of ruminant animals during the dry season.

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