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Utilisation of Ensiled Guinea Grass with Legumes for Meat Production by Bunaji Cattle in Oyo Town

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Abstract. Silage making is an effective way of preserving both the quantity and quality of forages which is of paramount importance in sheep production. Supplementing Legumes improves the quality of Panicum maximum. Information on P. maximum with these five legumes mixtures as silage is scanty. The potential of Panicum maximum ensiled with five types of legumes as dry season feed was therefore investigated. Silages of grasses wit legumes were made. Silage characteristics were determined. Twenty-eight Bunaji cattle were allotted to seven treatments on varying proportions of P. maximum ensiled with legumes : 100% P. maximum (1), T2=Pm-65%/35%Pp = 65% Panicum maximum +35%Pennisetum purpureus (2) , Pm-65/L-35 = 65%Panicum maximum + 35% Vigna spp. (cowpea) (3), Pm-65/A-35= 65%Panicum maximum + 35% Aeschynomene histrix +concentrate (4), Pm-65/C-35= 65%Panicum maximum + 35% Centrosema pubescens+concentrate (5), -65/S-35= 65%Panicum maximum + 35% Stylosanthes guianensis (6), Pm-65/V-35= 65%Panicum maximum + 35% Lablab purpureus (7) mixtures to assess Feed Intake (FI), Body Weight Gain (BWG) and Dry Matter Digestibility (DMD). Result indicated that Colour of silages was olive green with pleasant odour, firm texture, normal temperature (23-25°C) and pH range of 4.1-4.5. Least CP value was observed in diet 1 (9.0%) and highest in diet 4 (16.8%). Highest neutral detergent fibre, acid detergent fibre, acid detergent lignin were 56.1%, 39.4% and 9.4% respectively observed for diet 1. The least FI (573.87g) and BWG (23.81g) occurred in cattle fed 1 while the highest FI (715.47g) and BWG (47.62g) was reported for cattle fed 7 and 4 respectively. Least DMD (40.4%) was obtained from rams fed diet 5 while highest (56.9%) was for cattle fed diet7. 100% Panicum maximum diet had the least FI and WG while animals fed 65% Panicum maximum with 35% Lablab purpureus had the highest FI. Better feed intake, nutrient digestibility, and growth rates of rams could be achieved when 65% Panicum maximum basal diets are supplemented with either of Aeschynomene histrix or lablab purpureus at 35%. 65% Panicum maximum ensiled with 35% lablab or aeschynomene was thereby recommended.

Keywords: Bunaji cattle, silage, rumen fermentation, cultivated pastures

1. Introduction

Ruminant animals play a crucial part in livelihood sustenance and wellbeing of humans in the developing world.. They consume large quantities of humanly inedible roughages such as straw, bean husk and corn stalks etc for production and reproduction. Ruminant animals are physiologically adapted to obtain their nutrients from grass and they convert this low quality, high fiber feedstuffs to meat and milk that are important sources of protein, mineral, fat and vitamins.

Cattle are ruminant species that occupies a very important position in livestock industry many of which are used for work or milk with beef production only. Cattle depend too much on forages with nitrogen especially during the dry season to support production performances and maintenance. The availability of nitrogen in forages has a major influence on feed consumption, live weight and ecology of stock which graze extensively on pastures. So ruminants need to consume the much needed nitrogen in order to maintain their weights and production performances. Mainly natural pastures and crop residues provide dietary energy for dairy cattle but are generally unable to meet the nutrient

requirement for milk production and reproduction (Topps, 1997).

The Bunaji or White Fulani cattle is of Egyptian descent. Bunaji, at maturity have average body weight of 550kg (bull) and 340kg(cow). Although, they thrive on local grazing either nomadicor scavenging, as this tend to limit their production and they cannot meet the rapidly increasing human population. Low productivity of cattle in tropical/sub-tropical region is associated with low digestibility and low nitrogen contents of available feed resources. One of the ways of improving their nutritional status and under nutrition is by supplementation (Ismartoyo et al., 1993).
Nutrition is one of the important management practices in ruminant production and it is the bedrock of performance in animal; but if there are limited forages; and reduction in nutrient composition of the available forage grasses and legumes during dry season, this poses a problem.

One major problem of ruminant production in Nigeria is the scarcity of these fodder grasses and legumes (forages) throughout the year. Forages are the cheapest feed resources for ruminants but due to low pasture quality and availability they become low during the dry season. According to Bamikole et al., (2004) stressed that the bulk of the feed available to ruminants in the tropics is the grass forage, as this can be sourced cheaply. In an effort to alleviate ruminant feed supply problem, due to the fact that grasses are low in crude protein and insufficiently available in dry season, farmers need not depend solely on natural pastures but needs to practice cultivated or improved pasture management. However, good results have been obtained with forages of herbaceous legumes as supplements for small ruminants on low quality diets (Alasa, 2014).

In Nigeria, one of the major sustainable pastures is Panicum maximum.Panicum maximum grows naturally in many parts of Nigeria. Panicum maximum is a high yielding grass commonly used to improve pasture in Southern Nigeria (Alasa, 2014). It is well eaten by all classes of grazing livestock with particularly high intakes of young leafy growth. The major challenge of Panicum maximum which is similar to other tropical grasses is the rapid decline in the crude protein and soluble carbohydrate with age. Bamikole (1999) reported the nutritional quality of Panicum maximum becoming low with advancing age thereby suggesting cutting interval. Elliot and McMeniman (1987) reported forage legumes such as Lablabpurpureus, species of Leucaena, Sesbania and Gliricidia etcetera qualify as supplements to poor quality forage grasses due to high N and relatively low fibre content. Lablabpurpureus(Dolihus lablab)is an important forage legume that could be included in the feeding of animals (Rogers, 2002). It is palatable to livestock, is an adequate source for the much needed protein and can be utilized in several different ways.It has been observed that it increases livestock weight and production during the dry season (Murphy and Colucci, (1999).Aeschynomene histrix (Porcupine joint vetch) could be used in feeding animals. it has good drought tolerance capacity and highly nutritive.Centrosema pubescens is a long twining herbaceous legume that could be used in animal nutrition.it is drought tolerant (Skerman et al,1988).Stylosanthes guianensis(stylo) could be used to improve animal nutrition. Ensilage offers alternative means of fodder preservation during the rainy season while retaining nutrient quality of the forage without recourse to the use of fuel or solar energy for artificial hay making under wet, humid conditions (Kallah et al., 1997). Silage technology is another management practice employed for conservation of forages in an intensive animal production system. The sporadic year round shortage in the supply of pasture both in quantity and quality despite the abundant supply of feeds during the late rainy season, and that there are increasing indices towards intensification of livestock in Nigeria. Thus, there is need for conservation of forages through silage making. Bunaji migrated from the derived savanna to the edge of humid zone.

Thus, this research option for improving cattle productivity via improving nutrient value of ensiled forage grass and forage legume fed as basal diet, as forage quality and overall potential are best measured in terms of animal productivity (Bamikole et al., 2004). This study evaluated the performance of Bunaji cattle fed ensiled Panicum maximum-legume mixtures

2. Materials and Methods

2.1 Experimental Site

The experiment were conducted at the Teaching and Research Farm, Federal College of Education (Special),Oyo, Nigeria, Latitude about 6 ¹20° N, 3¹ 50° E, altitude about 200m above sea level between April and July in 2016 and 2017. The area has a tropical humid climate, the mean annual rainfall during the experimental period were 1150 mm and 1250 mm between April 2016 and July 2017 respectively. The mean monthly temperature was 26-29°C. Both the forage establishment and the feeding trials experiments were conducted at the same site.
Forage establishment and collection:

A total area of 4012m^2 was cleared, ploughed, harrowed, leveled and divided into thirty plots each measuring 22m x 12m with 1m pathways between plots. Crown splits of Panicummaximum were obtained from fenced and improved paddock within the College Teaching and Research Farm while five different of Legumes seeds were obtained from International Institute for Tropical Agriculture IITA, Moniya, Ibadan.The planting operation for the grass was first carried out on June , 2016 while legume were planted on September 2016, exactly 12 weeks when the grass planted earlier was cut back to a uniform height of 20cm.The depth of sowing using crown split was between 1- 2.5cm, crown split aids germination. Seeds of legumes were scarified to break dormancy and to enhance germination. Legumes seeds were soaked in hot water at 80° C for five minutes to break hard seed coat, they were air-dried before planting. Each legume seeds wasplanted 2-3seeds per hole in pure stands by drilling at 1m x 0.5m in grass with legume mixture. Weeding was carried out at every six weeks of harvesting of the pasture.

2.2 Pasture Harvest

Panicum maximum was harvested manually at six weeks from established plots where sole Panicum maximum,soleLablabpurpureussoleAeschynomene histrixSole Centrosema pubescens SoleStylosanthes guianensisand sole Vigna spp(cowpea)are planted. Sub – sample of each harvest was oven dried at 105°C to determine dry matter (DM).The sub-sample was be taken to the laboratoryand oven dried at 65°C for Nitrogen determination by Micro-kjeldahl method. Further, the sole Panicum maximum,Pennisetum purpureumand legumes were harvested manually at six week interval for four months. Sub-sample of each harvest was oven dried at 105° C.

2.3 Procedure Methodology

Study 1: Silage preparation and silage quality

Panicum maximum was obtained manually with knives from existing pasture established in 2016. Lablabpurpureus,Aeschynomene histrix,Centrosema pubescensStylosanthes guianensis (stylo), Vigna spp (cowpea) was be sown in September, 2016 and was harvested manually from each of the legume pure stands from the plots allotted for legumes every six weeks. This was continued till five harvesting are achieved. Pennisetum purpureum was also cut manually from existing pasture. Harvested forages were weighed in order to determine the expected amount for the making of silage. After harvesting the forages, they were chopped into 3cm lengths. Representative samples of known weight were taken for dry matter analysis. The harvested samples were wilted for two hours. The grass with legumes weighing 25kg in thirty replicates for the seven different treatments will be filled in a 25kg capacity plastic used as storage silos. The storage silos will be lined with white polythene. Cassava peels were included at 10%into each silo. For each treatment, additive was thoroughly mixed together with hand before rapidly filling the silos, compacted and compressed and trampled with legs. Silos were compacted, consolidatedand sealed airtight to exclude any air present in the silo. This was to secure an anaerobic condition. Sand bags were placed on each silo.Silages were made into seven treatments comprising the mixtures of Panicum maximum and Lablabpurpureus, Aeschynomene histrix,.Centrosema, Stylosanthes guianensis and Vigna spp (cowpea). The seven treatments are also the experimental diets with which the animals would be fed.

T1=Pm-100 = 100% Panicum maximum

T2=Pm-65%/35%Pp = 65% Panicum maximum +35%Pennisetum purpureum

T3=Pm-65/L-35 = 65%Panicum maximum + 35% Vigna spp. (cowpea)+ concentrate

T4=Pm-65/A-35= 65%Panicum maximum + 35%Aeschynomene histrix+concentrate

T5=Pm-65/C-35= 65%Panicum maximum +35%Centrosema pubescens+concentrate

T6=Pm-65/S-35= 65%Panicum maximum +35%Stylosanthes guianensis+concentrate

T7=Pm-65/V-35= 65%Panicum maximum +35%Lablab purpureus+concentrate

2.4 Determination of silage quality

After 40 days, fermentation was terminated and siloswere opened for silage quality. A laboratory thermometer was inserted to determine the temperature.

pH determination: The pH of sub sampled silages were taken by heating 100g of each sub sample in a beaker containing 100mls of distilled water for 5 minutes at 60°C. The supernatant liquid were decanted, cooled at room temperature and digital pH meter were used to determine the level of the pH.Colour: Colour assessment was ascertained by using visual observation with the aids of colour charts.odour: The odour or smell of the silage was relatively assessed as to whether nice or pleasant or fruity/vanilla. (Mannetje. L't., (1999).

2.5 Chemical Analysis

Dried Samples for the ensiled forages were analyzed for crude protein, crude fibre, ether extract, and ash, according to the methods described by (AOAC, 1990). Neutral detergent fibre, acid detergent, fibre,

and acid detergent lignin were determined according to the Goering and Van soest, (1991) method.

2.6 Statistical analysis

Data were subjected to analysis of variance using the procedure of SAS (1999). Significant means were separated using the Duncan Multiple Range F-test. Experimental mode of the design is: $Y_{ij} = \mu + \alpha 1 + £ij$

Where Y_{ij} = individual observation μ = general mean of population

α1 = Treatment effect and £ij = Composite error effect

STUDY 2

Experimental Animals and Management

Twenty eight Bunaji cattle of both sexes, average age of eight months old and 160.17kg - 200.50kg liveweight were used for the feeding trial. The animals were confined for one month adaptation period. During this period they were treated against external and internal parasite infections.Panicum maximum and cassava peels were fed ad libitum as well as vitamin and mineral supplement in form of salt-licks.The cattle were weighed and randomly divided into seven treatment groups of three animals per treatment in a completely randomized design. The animals were balanced for weight such that the initial weights were not statistically different. The cattlewere housed in individual pens measuring 5m x 2m in concrete –floored pens partitioned with slatted planks to allow visual contacts. The pens were cleaned and washed thoroughly with warm disinfectant to remove dirts and obnoxious odour prevailing in the house.

2.7 Animal feeding

The cattle were weighed on arrival, rested, watered and tagged for easy identification. cattle were fed with the feedstuff (including grass, cassava peels and wheat offal), which they consumed from where they were purchased during the acclimatization periods.The animals were placed on prophylactic treatment through the administration of antibiotics (long acting). Animals were treated against endo-parasites and ecto-parasites. They were allowed to adapt for 1 month and will also be fed with concentrate supplementation.

After adaptation, the animals were randomly grouped into seven treatments in a completely randomized design comprising four animals per diet. Animals were individually kept in separate pens that were previously embedded with wood shavings. Feeders and drinking troughs were placed in the pens for free access to feed and fresh water daily. Feed were offered at approximately 5% of their body weight. Voluntary feed intakes were estimated as the difference between feed offered and feed refusal. The animals were weighed prior to feeding to minimize error due to "fill" in the morning on a weekly basis to calculate average weight gain. A one hundred and fifty (150) day feeding trial was carried out during January, 2017 to July 2017.

2.8 Experimental diets

In a completely randomized design with four replicate cattle were randomly distributed to ensiled treatment diet.The performance characteristics ofBunaji cattle that were fed a basal diet of Panicum maximum andPanicum maximumsupplemented with five different forage legume.

For the performance of the growing cattle placed on the experimental dietsthe following indices will be measured:

* The Dry Matter intakes of the cattle
* The initial body weight
* Final body weight,
* Daily Weight Gain (DWGg/day)
* Feed Conversion Ratio (FCR)

3. Results

Table 1: Chemical Composition of the ensiled Panicummaximum with Legumes mixture fed to Bunaji cattle

	DM	CP	CF	EE	ASH	NDF	ADF	ADL	HEMI	CELL
T1	46.39^{a}	9.01^{d}	33.08^{b}	8.15^{d}	10.01^{b}	56.16^{abc}	39.42^{a}	9.42^{ab}	12.59^{ab}	27.99^{ab}
T2	33.10^{e}	15.13^{c}	36.15^{b}	9.05^{cd}	11.33^{ab}	44.73^{cd}	37.41^{abc}	8.61^{bc}	5.31^{b}	30.81^{a}
T3	36.26^{de}	15.18^{b}	37.07^{b}	10.35^{a}	12.00^{ab}	48.58^{bc}	38.75^{ab}	8.73^{bc}	9.83^{ab}	30.02^{a}
T4	41.47^{bc}	16.75^{c}	36.33^{b}	9.16^{bcd}	12.01^{ab}	54.36^{ab}	36.71^{abc}	9.15^{ab}	17.65^{a}	27.56^{ab}
T5	35.62^{de}	15.16^{c}	35.51^{b}	10.11^{ab}	11.01^{ab}	52.98^{ab}	37.61^{abc}	8.25^{bc}	15.37^{a}	29.36^{a}
T6	39.80^{cd}	15.16^{c}	46.05^{a}	8.80^{cd}	12.97^{a}	50.01^{ax}	37.53^{abc}	8.61^{bc}	18.63^{a}	28.92^{a}
T7	43.49^{abc}	16.51^{c}	36.17^{b}	9.56^{abc}	12.00^{ab}	53.60^{ab}	34.53^{bc}	7.80^{c}	19.10^{ab}	26.75^{a}
SEM	1.36	0.45	6.32	0.33	0.81	2.20	1.35	0.37	2.83	1.61

^{a,b,c,d,e} means with different superscript along the same column are significantly different($p<0.05$)

Table 2: Performance characteristics of Bunaji cattle Fed ensiled Panicum maximum and legume mixture

Parameter	T1	T2	T3	T4	T5	T6	T7	SEM
Initial body weight (Kg)	160.17	165.00	155.33	200.50	165.50	165.33	165.00	0.68
Final Body weight (Kg)	162.17^{b}	167.33^{ab}	158.83^{a}	204.50^{a}	167.83^{ab}	168.83^{a}	168.92^{a}	0.64
Body weight gain (Kg)	2.00^{b}	2.33^{ab}	3.50^{ab}	4.00^{a}	2.33^{ab}	3.50^{ab}	3.92^{a}	0.60
Daily weight gain (g/day)	23.81^{b}	27.78^{ab}	41.67^{ab}	47.62^{a}	27.78^{ab}	41.67^{ab}	46.63^{a}	6.63
Dry matter intake (g/day)	573.87^{c}	658.15^{ab}	673.11^{ab}	700.11^{a}	626.25^{bc}	683.62^{ab}	715.47^{a}	23.26
Feed conversion ratio	24.10^{c}	24.42^{c}	17.77^{b}	15.82^{a}	24.66^{c}	18.11^{b}	16.05^{a}	3.56

^{a,b,c} means with similar superscripts along the same row are not significantly different ($p< 0.05$)

4. Discussion

Some of the determinants of suitable forage species for use as a silage material include high yield per unit area, nutritional quality at ensiling and quality of the resultant silage (Kallah etal, 1997). The treatments evaluated did manifest a defined trend for Dry Matter (DM) as fed .Apart from the dietary treatment 1 and 2,the other treatments with 25% levels of inclusion of legumes irrespective of the species had increasing percent of DM.

The Crude Protein (CP) content of the prepared silage was outstanding. The CP of the Panicummaximum obtained in this study compared well with values reported in literature (Babayemi, 2009). The CP of the Panicummaximum obtained in the present study is higher than the critical value of 90g/kg recommended for large ruminants (NRC, 1981) and very close to the minimum requirement of 10-12% recommended by ARC (1985) for ruminants. Titterton and Maasdorp (1997) recommended 40% inclusion of legumes in grass – legume silage. In mixed Panicum maximum – legume silage, Panicum maximum provides the fermentable carbohydrate while the legumes improve the protein of the silages. The level of CP in the sole Panicum maximum is above the minimum requirement for ruminants (Minson, 1990).

The NDF values obtained for the grass and forage legumes are within the range of 24 – 61 reported for tropical forages (Topps, 1997). While, silages prepared with lablab and Panicum maximum, in addition, lablab contributed more to the content of EE in the silage prepared. This could perhaps mean that lablab is higher in some components of nutritive value relative to others. While crude protein values realize for sole silages compare with data reported by Kallah etal., (1997), higher values were obtained from the legume fortified silages.

The higher total dry matter intake DMI for the legume supplemented diets (diets 3-7) compared with the Panicum maximum diet only (diet 1) in this study could be due to the higher crude protein content and low NDF and ADF contents of the legumes. diet 2 was a combination of two grasses(Panicum and Pennisetum) fed to ruminants. The DMI for the 35% Aeschynomene histrix and lablab supplemented diets (diets4 and 7) were significantly similar, were higher than DMI for diet 1.The DMI for the 35% Vigna and stylosanthes supplemented diets (diets3 and 6) were significantly similar and were higher than DMI for supplementary diets 5. The DMI for the 35% Aeschynomene and Lablab supplemented diets (diets 4and 7) were significantly similar and were higher than DMI for supplementary diets (diets 3and 6). The same trend follows for DWG. It is a known fact that the high CP content of a feed stimulates more feed intake (Oldham and Alderham, 1980). The similarity of the DMI of the legumes supplemented diets 3&6, 4&7, Could be ascribed to the comparable values of the CP contents of the legumes.

Low DMI reported for Panicum maximum could be linked to the high NDF content of the grass. A feed high in NDF usually has low voluntary intake as it occupies a large volume in the rumen.NDF concentration is used as an index of gut fill to predict voluntary feed intake. Supplementation of a basal diet of grass or crop residue with legume usually increases DMI of the animals. This conforms to earlier findings (Mtenga and Shoo, 1990). Cattle fed diet 4&7 had the least feed conversion efficiency. This was an indication that the two diets were the best utilized.

5. Conclusion

Improved dry matter intake, nutrient digestibility, nitrogen utilization and growth rates of cattle could be best achieved when Panicummaximum basal diets are supplemented with either of the two of the legumes(Aeschynomene histrix &Lablab purpureus)

at 65:35. Cattle placed on 65% Panicummaximum with 35% lablab and Aescynomene performed best followed by those fed 65% Panicummaximum with 35% vigna and stylosanthes. Similarly cattle placed on 65% Panicummaximum with 35% cowpea and cattle placed on 65%panicum maximum with 35% pennisetum purpureum performed better than those on sole grass orPanicummaximum.

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