EFFECTS OF SOLE AND MIXED GRASSES/LEGUMES SILAGE ON NUTRIENTS DIGESTIBILITY AND NITROGEN BALANCE ON YANKASA RAMS.

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Abstract
The study was aim to evaluate apparent nutrient digestibility and nitrogen balance on growing Yankasa rams at National Animal Production Research Institute (NAPRI), Ahmadu Bello University (ABU) Shika,. Rams averagely weighing 21.5kg were fed a basal diet of sole maize (SM), sole elephant grass (SE), maize lablab (ML), maize mucuna(MM), elephant grass lablab (EL) and elephant grass mucuna (EM) and silages with concentrate supplement (1%) of their body weight for a period of 90 days and 21 days digestibility studies in a Completely Randomized Design (CRD). Rams fed ML recorded significantly higher (P<0.05) DMD (67.95%), CPD (66.12%) and OMD (56.12%) and sole maize recorded the lowest DMD and CPD. However, significantly (P<0.05) higher ADFD and EED was obtained in EL (80.78%) and EM (80.22%) respectively. Rams fed SM silage recorded lowest NDFD and ADFD. Result on nitrogen balance obtained reveal that significantly (P<0.05) higher nitrogen intake was recorded in rams fed with EL but rams offer EM feed recorded higher N retained (23.35g/day) and nitrogen retained as percentage intake (68.85%) in their body compared to other treatments and were significantly different.
Key words: Nitrogen Balance, Nutrient Digestibility, Yankasa Rams, Silage

Introduction
Ruminant animals contribute substantially to world's human food supply, especially in marginal areas or the tropics where population is on the increase (Migongo-Bake, 1991). Small ruminants are produced with the aims of getting meat, milk, wool and skin. The four products assumed varying degree of importance in different countries depending on the existing agro ecological condition (Paer *et al.,* 2013). Feed quality and availability are major constraints in increasing ruminant animal productivity under tropical conditions. Basal feed often provides inadequate protein, minerals and vitamins to support optimum animal productivity during dry season. Supplementary feeds are used as sources of protein and energy to augment the deficiencies from basal diet (Adediran, 2002).
Silage production is among the forage conservation methods practiced in intensive livestock production system. While it is not a common practice among the livestock producers in Nigeria, silage is a viable option for preservation of surplus quality forage during the growing season when yield and nutritional values are optimal (Kallah *et al.,* 1997). Under the tropical pattern of pasture production in the Savannah, sustainable supply of feeds can be achieved through judicious choice of suitable plant species, soil fertility management and fodder conservation practices (Kallah, 1990). Manipulation of forage species selection, production technique and fodder conservation practices effectively bridge the gap in feed supply during the dry season for increment of growth, milk yield, and survivability. Silage making offers a means of improving the utilization of pasture such as Gamba grass and Elephant grass silage, which serves as a means of enriching fodder and its optimum conservation (Mohammad *et al.,* 2009). Ruminants prefer

grass/legume silage as they produce more milk and lambs grow faster on grass-legume silages as compared to grass silage alone due to higher crude protein, vitamins and essential minerals content (Wilkin, 2001). This study was aimed to evaluate the effect of feeding mixed grasses, / legumes silage and concentrate ration on digestibility and nitrogen balance of Yankasa rams.

Materials and methods

The study was carried out at the Small Ruminant Experimental Site in the Small Ruminant Research Programme of Shika, . Thirty (30) growing Yankasa rams aged between 8-12 months with average initial weight of 21.5kg were used for the study. .During the period, the animals were given prophylactic treatment against internal and external parasites and tagged for easy identification. They were housed in individual pens and balanced for their weights, then allotted to 6 dietary treatments with 5 rams per treatment in a CRD. The rams were offered concentrate diet at 1 % of their body weight and the experimental diet (silage)*ad-libitum*. Clean freshwater and mineral salt licks were offered at free choice daily.

The nutrient digestibility study was also carried out at the Small Ruminant Research Programme (NAPRI) using eighteen Yankasa rams (average initial weight of21.5 kg[hp1] with three (3) ram per replicate in a Completely Randomized Design. The animals were carefully examined for good health, deworm with Ivermectin and randomly selected from each treatment groups. They were housed in individual metabolism crates. Fourteen (14) days adjustment period were allowed for the animals to get used to the cages and feeds, followed by 7 days daily faecal and urine samples collection. The samples were weighed and sub sampled (40g) taken and oven dried before they were bulked, milled and stored in polyethene bags until required for analysis. The daily urine output from each ram was collected in graduated plastic containers containing 25mls of 0.1N H_2SO_4 which was placed under the metabolism crates. About 10 % of the daily urine output (aliquot) was collected from each ram, bulked and stored in a freezer at (-2^{0}C) until required for analysis. The urine collection lasted for 7 days**.**

Chemical analysis

Samples of the sole grass and mixed grass legumes silage were subjected for chemical analysis. The dried samples of forages material were ground using a hammer mill and passed through 1-2mm sieve. Proximate analysis was carried out to determine Nitrogen (N) for crude protein determination (Nx6.25), Crude Fibre (CF), Ether Extract (EE) and ash content according to (AOAC, 2005). Neutral Detergent Fiber (NDF) and, Acid Detergent Fiber by method of Van-Soest *et al.* (1991).Nitrogen Free Extract (NFE) was determined by subtraction of Moisture, Crude Protein, Crude Fibre, Ether Extract, from 100. The feed samples and faeces were analysed in laboratory for Crude Protein (CP), Crude Fibre (CF), Ether Extra (EE) and Ash using the procedure of AOAC (2005).

Statistical analysis

Data collected on nutrient digestibility and nitrogen balances were analyzed by ANOVA using the General Linear Model Procedure of (SAS, 2005). Significant treatment means were separated using Dunnet's test.

Results and Discussion

Nutrients digestibility of Yankasa rams of grass-legumes silage

Table 1 shows the mean values of nutrient digestibility of Yankasa rams fed mixtures of grass legume silages. There was significant difference (P<0.05) in all the digestibility coefficients measured across the treatments except for nitrogen free extract which were not significant. The dry matter digestibility of sole Elephant and Maize/Lablab silages were at par (P>0.05), but higher (P<0.05) compared to other treatments. However, rams fed sole Maize silage had the least

(P<0.05) dry matter digestibility compared to those rams fed other silage mixtures. Digestibility of crude protein were higher (P<0.05) in Yankasa rams fed Maize/Lablab silage (66.12%) and Elephant grass/Lablab silage (65.12%) with the least (P<0.05) recorded in rams fed Elephant grass/Mucuna silage.

The digestibility of organic matter, was higher (P<0.05) in Yankasa rams fed sole Elephant grass, Maize Lablab and Elephant grass Lablab silage compared to other treatments. The digestibility of Acid detergent fibre (ADF) and neutral detergent fibre (NDF) were significantly (P<0.05) affected by silage mixtures. Yankasa rams fed sole Maize silage recorded the least (P<0.05) digestibility of ADF and NDF of 36.41% and 66.33% respectively, compared to other treatments silage.

Rams fed with grass ensiled with lablab showed better dry matter digestibility, crude protein and EE digestibility when compare with other treatment as showed in table 4.13. However, ensiled grasses with Mucuna recorded higher NDF digestibility than lablab ensiled with grasses. Lowest CP digestibility was observed in ensiled sole grasses silage. Higher ADF digestibility coefficients were recorded in ensiled EL and MM when compare with sole grasses silage.

The DM digestibility in this study was similar with report of Falola *et al.* (2015) were he ensiled vetiver grass with cassava peels (100:0, 80:20, 70:30, 60:40 and 50:50) and recorded DM at range of 63.91-66.79%. However, this result was lower than report of Falole *et al.* (2015) and Aderinole *et al. (*2008) respectively in goat fed fresh vetiver grass (77.68-84.24%). Variation in this result of DMD might be due different foliage processing method used, chemical composition of the forage material fed or different species of animal used in the range of (49.09-66.12%).

Higher crude protein digestibility in lablab mixed with grasses in this study confirms the report of Abdu *et al. (*2012) and Hassan *et al.* (2016) that higher digestibility values obtained could be attributed to crude protein content of the diet which in turn improve the digestibility of the diet. The result in this study was in line with Zhulin Xve *et al.* (2022) who observed combining of orchard grass with alfalfa optimized the ruminal degradation and fermentation efficiency through complementary effects of nutrients in forage in silage mixtures.Furthermore, Zhulin Xve *et. al.* (2022) states in line with this study that the degradable and rapidly digested N from legumes compensated for the slow release of N from grasses and coincided with association and shift in the ruminal microbial community to better degrade the fiber fraction in grass/legumes mixtures. The report obtained is in line with the study of Ngongoni, (2008) where he observed that increase in N supply for the micro flora would have increase rate of digestion with resultant increase in rate of passage and voluntary feed intake.

Crude protein digestibility obtained in this study was lower than the report of Falole, (2015), in his experiment goats were fed vetiver grass ensiled with cassava peels (76.71-77.81%) CP. Consequently, the digestibility of NDF and ADF tends to increase in rams fed elephant grass lablab and elephant grass mucuna silage. This agrees with the report of Ranjhan, (2001), who reporteds higher protein intake and content to increase digestibility of fibre fraction of feed because of the activities of microorganism which attacks the crude fibre the more. However, ADF digestibility tends to increase in mixed grass-legumes silage than sole grass silage. This might be as a result of the legumes added which increase protein content of the diet.

Nitrogen balance of Yankasa rams fed grass/legume silage mixtures

The results of nitrogen balance of fattened Yankasa rams fed grass legume silage mixtures are presented in Table 3. Nitrogen intake (g/days) had significant (P<0.05) difference across all the treatments. The elephant grass/lablab (35.5g/day) silage mixtures gave the highest nitrogen intake in Yankasa rams fattening that is significantly higher than elephant grass mucuna (33.91). The least nitrogen intake was obtained with Yankasa rams with maize mucuna (26.92). Urinary N (g/day) was similar across all the treatments of fed mixture grass legumes silages. Sole elephant grasss silage gave the highest feacal nitrogen across all the treatment that is similar to maize mucuna treatment. According to the result, the highest feacal nitrogen was recorded by elephant grass across mucuna treatment. Total N output was not significant (P>0.05) across all the treatments (10.50 – 15.81g/day). There were no significant difference (P>0.05) in all parameters determined across all the treatments except for nitrogen retained and nitrogen retained as percentage of intake. Rams on Elephant grass/Mucuna and Elephant grass/Lablab silages, had the highest nitrogen retained and which was significantly (P<0.05) higher compared to the other treatment groups. When the quantity of nitrogen retained was expressed as percent of nitrogen intake, rams fed with Elephant/Mucuna silage had the highest nitrogen retained (68.85%), and it was significantly different (P<0.05) compared to those of other treatments. Rams fed on Maize/Mucuna silage had the least (P<0.05) per cent of nitrogen retention (47.99%).

The study of nitrogen balance in yankasa rams fed with sole grass and mixed grass legumes silage were presented in table 4. The nitrogen intake value was higher in rams fed Elephant grass lablab (35.50g/day) silage followed by elephant grass mucuna **s**ilage (33.91g/day) and the least nitrogen intake was in maize Mucuna (26.92g/day). Nitrogen retained and nitrogen retained as percentage was higher in rams fed elephant grass Mucuna silage. However, faecal N output was lower in elephant grass Mucuna silage. Furthermore, the urinary nitrogen values obtained were from 1.50-2.0g/day. The result of feacal nitrogen output does not agree with Satan *et al.*(2019).He reported N intake in sheep to be a major driver of feacal N when he compared feeding king grass silage with *Leucaena leucocephala* or *Gliricidia sepium*. The result agreed with findings of Clerk *et al.*(1992) who reported that feed silage with grass dominates sward led to higher N enrichment of microbial N along with smaller microbial N yield than feeding silage mixtures of grass clover and other forbs.

The result observed on feacal and urinary nitrogen output is not in line with findings of Al-Asfoor (2010) who reported that the nitrogen concentration of feaces strongly depend on the N concentration of the diet.However, the superiority of N retention in a specific ration is usually affected by several factors which include possible production of microbial protein synthesis and increased presence of fermentation energy accordingly. (Hegemaiser *et al.,* 1981).Also differences in availability of fermentable energy (Tagari *et al.,* 1974) coupled with variety in nitrogen which might escape fermentation from the rumen influence fermentation from the rumen influence of nitrogen retention in animals (Holzer *et al.,* 1986). All these explain reason for variation in nitrogen retention that affected silage treatments in this study. However, all the animals were in positive nitrogen balance which indicated growing yankasa rams received adequate amounts of nitrogen from the diet. (Abdu *et al.,* 2012).

Conclusion

There was higher DMD, CPD and OMD in rams fed ML silage than sole maize silage and better ADFD and NDFD in rams fed with EL silage diet than rams in SM silage diet. Elephant grass/lablab and Elephant grass/mucuna silages mixtures recorded higher nitrogen retained and absorbed compared to sole Elephant grass silages.

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Table1**: Nutrient digestibility of mixed grass / legume silage fed to growing Yankasa rams.**

Parameters (%)	SM	SE	MM	ML	EL	EM	SEM	LOS
Dry matter	56.39[c]	61.57[b]	56.00[c]	67.95[a]	65.13[a]	65.58[a]	1.31	*
Crude protein	67.39[bc]	49.09[c]	54.06[b]	56.39[a]	65.12[a]	52.00[bc]	1.66	*
Organic Matter	42.21[b]	39.09[b]	34.06[c]	56.12[a]	48.92[a]	52.00[a]	2.39	*
Ether Extract	71.11[a]	58.00[b]	66.12[b]	74.41[a]	76.48[a]	80.22[a]	4.98	*
NDF	36.41[b]	40.02[a]	42.01[a]	38.61[ab]	40.17[a]	41.36[a]	1.24	*
ADF	66.33[c]	73.00[b]	70.99[ab]	72.07[b]	80.78[a]	68.61[bc]	1.36	*

[abc]Means bearing different superscript differ significantly (P<0.05), SEM= Standard Error of Means, *= P<0.05; NS= Not significant, %= percent, ML= Maize lablab, MM=Maize Mucuna, EL= Elephant grass lablab, EM= Elephant grass Mucuna, SM= sole maize silage, SL= sole Elephant grass silage, SEM= standard error of mean

Table 2: Effect of sole and mixed grass/legume silage on nitrogen balance of Yankasa rams

Parameters	SM	SE	MM	ML	EL	EM	SEM	LOS
Nitrogen Intake (g/day)	29.44[d]	31.50[c]	26.92[f]	28.77[e]	35.50[a]	33.91[b]	0.14	*
Urinary-N (g/day)	1.94	2.0	1.83	1.61	1.50	1.50	1.33	NS
Fecal-N (g/day)	10.16[bc]	13.81[a]	12.17[ab]	9.12[cd]	11.12[bc]	9.06[d]	1.20	*
Total-N output (g/day)	12.10	15.81	14.00	10.73	12.62	10.56	4.99	NS
N-Retained (g/day)	17.34[bc]	15.69[cd]	12.92[d]	18.04[b]	22.88[a]	23.35[a]	2.07	*
2N-Intake as N- Retained (% N-intake[hp2])	58.89[c]	49.80[e]	47.99[f]	62.70[b]	54.45[d]	68.85[a]	0.55	*

[abc]= Means bearing different superscript differ significantly (P<0.05), SEM= Standard Error of means, *= P<0.05; NS= Not significant, N= Nitrogen, %= percent, ML= Maize lablab, MM=Maize Mucuna, EL= Elephant grass lablab, EM= Elephant grass Mucuna, SM= sole maize silage, SL= sole Elephant grass silage, SEM= standard error of mean