ISSN 2348-313X (Print)
International Journal of Life Sciences Research ISSN 2348-3148 (online)
Vol. 4, Issue 1, pp: (15-21), Month: January - March 2016, Available at: www.researchpublish.com

Performance of Yankasa Rams Fed Urea Treated Sorghum Chaff as a Basal Diet Supplemented With Maize Offals in Semi - Arid Environment of Nigeria

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Abstract: **Sixteen (16) Yankasa Rams weighing between 17.01kg to 17.84kg were used to evaluate the Performance of Yankasa rams fed Urea treated sorghum chaff as a basal diet supplemented with different levels of maize offal. 4% urea treated sorghum chaff was supplemented with maize offal at 0.00g, 100g, 150g, and 200g. The feeding trial was conducted for a period of 90 days. Treatment (T_1) was the control, fed untreated sorghum chaff only (as basal diet), while animals on Treatments T_2, T_3 and T_4, were supplemented with maize offal at 100g, 150g and 200g respectively. The results revealed a significant increase in DMI and ALW with T1, T2, T3 and T4 having 285.00g/h/day (DMI) and 33.56g/day (ALW), 292.50g/h/day (DMI) and 43.78g/day (ALW), 305.75g/h/day (DMI) and 53.89g/day (ALW), and 328.75g/h/day (DMI) and 62.89g/day (ALW) respectively. Highest feed intake was recorded in T4 (328.75g/h/day) while T1 had least (285.00g/d/h). There was no significant difference water intake of the rams among the treatments, with T4 recording highest value of 3.61 liters and lowest value in T1 2.57 liters. The percentage digestibility of the experimental diets was highest in T_4 and T_3 than T_1 and T_2 respectively. The nutrients digestibility increased among treatments with increasing levels of supplementations. Feeding 4% urea treated sorghum chaff and maize offal with inclusion level of 200g is recommended for feeding Yankasa rams during the dry season.**

Keywords: **Basal, live weight, Maize offal, Sorghum Chaff, Performance, Urea, Yankasa rams.**

1. INTRODUCTION

Forages, crop residues and by-products are usually consumed fresh by domestic animals. However, it is possible to conserve them for use during future periods of feed shortage. Conservation can be achieved by sun drying (hay) and by fermentation (silage) Falola *et al*., (2015). Type and quality of feed ingredients used in meeting nutritional requirement of ruminant animals plays a significant role in combining two or more feed ingredients to produce a balanced ration for feeding ruminants (Malgwi and Mohammed, 2015). Fermentation by silage making can be done using fresh or preferably wilted materials. Ensiling is the preservation of forage, crop residues and by-products based on lactic acid fermentation under anaerobic condition. The lactic acid bacteria ferment the plant sugars (water soluble carbohydrates) in the crop to lactic Mannatje, (1999). Ensiling is done to preserve forage resources for the dry season in the tropics in order to ensure a continuous regular feed for livestock to sustain growth, for fattening or milk production Falola *et al*., (2015). Most feeds during the dry season in the tropics are deficient in nitrogen hence there is urgent need to explore other sources of supplementary protein in order to avert weight loss in ruminants and enhanced their productively. Urea is successfully used to improve the low nitrogen contents of sorghum chaff consumed by cattle and sheep Iwuanyanwu and Lakpini, 2008. Since utilization of crop by-products and crop residues to formulate rations for ruminants can meet both their metabolizable energy, protein and mineral requirements for both maintenance, production and reproduction at a very lower cost especially during periods of feed shortage (dry season) Malgwi and Mohammed (2015), this research intends to investigate the effect of feeding urea treated sorghum chaff as basal diet supplemented with different levels of maize offals on the performance of Yankasa rams in the Semi-arid region of Nigeria.

2. MATERIALS AND METHODS

Study Area:

The research was conducted in the Ministry for livestock Production and Nomadic Settlement premises located in Yola North Local Government Area of Adamawa State-Nigeria. The Local Government lies within the Northern Guinea Savanna between latitude 7^oN and 11^oN and longitude 11^oE and 14^oE of the Equator. The region normally experience a maximum temperature of 40^oC in the month of February and as low as 15^oC within the months of November to January. The temperature varies within the state where temperature of about 26.7^oC in the southern part (Adebayo and Tukur, 1999).

Experimental Procedure and Management of Experimental Animal:

Sixteen (16) Yankasa rams aged between 8 – 10 months weighing 17.5$\pm$ 1 kg was subjected to four dietary treatments. The animals were housed in a simple shed made of wood and thatches (dry grass) to prevent them from harsh weather. The animals were fed separately twice daily at 8:00am and 3:00pm. Water and mineral licks were made available to the animal *ad-libitum*. The experimental diets were offered to the animals in plastic rubber containers at 8:00am and 3.00pm daily. The initial weight of the animals were taken and balanced before the commencement of the experiment. Thereafter the live weight gain was measured weekly. The left over feed was weighed daily before fresh feeds were given for the determination of dry matter intake. The experiment lasted for three (3) month including the adaptation period of two (2) weeks.

Experimental Design:

Completely Randomized Design (CRD) was used for the experiment and three (3) rams were allocated to four dietary treatments replicated (4) times which gave a total of sixteen (16) experimental units.

Experimental Diet and Treatments:

The basal diet offered was ensiled sorghum chaff, fifteen (15) bags of sorghum chaff weighing 100kg each was procured from local farmers in Jimeta-Yola and its environs in Adamawa State. The sorghum chaff weighing 100kg each was sprinkled with urea solution composed of 4.0 kg urea dissolved in 100 liters of water. The sorghum chaff was dried before ensiling in order to reduce moisture content, the treated sorghum chaff was covered with a polythene sheet in a pit and left to stand for 21 days (3 weeks). A pit of 1.5m diameter and 2.0m height was dug where the feed was ensiled and covered to the upper part of the pit, in order to achieve anaerobic condition as reported Khan and Davis, (2004). Fermentation completely ceased after 21 days (3 weeks) and all microbial growth got inhibited. After 21 days, the polythene sheet was opened and allowed to aerate for 24 hours to allow ammonia to escape which may likely cause the product to smell. This procedure gave an attractive end product with pleasant aroma, mellow, palatable and attractive to the animal (Khan and Davis, 2004), and it also aided better urea hydrolysis. Sundstol, (2003) reported that, treatment at the rate of 70 liters of water (urea solution), to 100kg of sorghum chaff resulted in adequate wetting of the sorghum chaff and hence result to poor fermentation process.

Chemical Analysis:

Proximate Analysis of ensiled sorghum chaff treated with urea, maize offal, faeces and nitrogen in the urine was carried out using the procedure outlined by AOAC, (2004) to determine the dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE), ash and nitrogen free extract (NFE).

Statistical Analysis:

Data Analysis The data collected was subjected to analysis of variance (ANOVA) in a completely randomize design (CRD) as described by (Gomez and Gomez, 1984), after which the least significant difference (LSD) test was used to separate the means where significance difference exist (Obi, 2002).

3. RESULTSAND DISCUSSION

Table 1: Chemical Composition of Urea Treated Sorghum Chaff (UTSC) as a Basal Diet Supplemented with Maize Offal.

Parameters (%)	Untreated Supplement	Basal Diet (Treated)	Maize offal
Dry matter (DM)	85.00	97.20	4.00
Crude protein (CP)	4.90	15.68	96.00
Crude fibre (CF)	35.60	32.50	27.85
Ether extract (EE)	0.41	5.50	1.40
Ash	6.60	9.00	4.10
Nitrogen free extract (NFE)	32.40	34.52	50.75
Energy, ME (Kcal/Kg)	1364.71	2251.12	2355.33

Chemical composition of urea treated sorghum chaff (UTSC) and maize offal (MO) is presented in Table 1 which shows that the urea treatment improved the crude protein content of sorghum chaff from 4.90% to 15.68%. This is above the normal range of about 7.7% which is the critical value recommended for small ruminants (NRC, 1981) and higher than the minimum protein requirement of 10-12% recommended by ARC (1985) for ruminants. The result obtained for % CP in this experiment is higher than the range of 5.0 - 11.0%CP reported by Lukden and Finangwai, (2013) where Acha (*Digiteriaexilis*) was treated with urea and slightly lower than the value 16.04 - 16.16%CP reported by Oloche *et al.*, (2013). The CF values ranged 27.80 - 32.50%CF were higher than the values (15.56 to 18.67%) reported by Fasino (2012). The EE value 1.40 to 5.50 %EE was lower than the values 5.00 - 6.80%EE reported Maigandi and Abubakar, (2004). The NFE value 34.52 - 50.75 %NFE was lower than the values 56.00 - 56.54 %NFE reported Oloche *et al.*, (2013). Further, variation in chemical composition of the treatments could be as a result of the inclusion of urea and level of supplementations of the different ingredients. This is in concord to the report of Msheliza *et al.*, (2015) who reported increased degradability among formulated rations using locally available feed resource and attributed the existing variation in degradability of the formulated feed rations to inclusion level of ingredients used during the formulation process.

Table 2: Performances of Yankasa Rams fed Urea Treated Sorghum Chaff (UTSC) as Basal Diet Supplemented with Maize Offal

Parameters	Treatments				
(%)	T1	T2	T3	T4	LSD
Total feed intake (g//h/day)	285.00	292.50	305.75	328.75	3.247**
Daily water intake (lit/h/day)	2.57	2.67	3.38	3.61	0.585^{ns}
Feed conversion ratio	8.49	6.68	5.67	5.23	2.452^{ns}
Feed conversion efficiency	0.11	80.14	90.17	60.19	13.049^{ns}
DMI as % BW	1.40	1.42	31.46	71.57	2.407**
Initial live weight (kg)	17.10	17.48	17.59	17.84	1.471^{ns}
Final live weight (kg)	20.12	21.42	22.44	23.50	1.385^{ns}
Total weight gain (kg)	3.02	3.94	4.85	5.66	1.201*
Average daily live weight gain (g/d)	33.56	43.78	53.89	62.89	5.382**

ns = Not Significant
* = Significant (P<0.05),
** = Highly Significant (P< 0.01)
UTSC = Urea Treated Sorghum Chaff
g/h/d = grams / animal / day
ltr = Liters

The performance of Yankasa rams fed urea treated sorghum chaff (UTSC) as a basal diet supplemented with maize offal is presented on Table 2. There is a significant (p<0.05) difference in DMI of Yankasa rams fed experimental diets. Dry matter intake varied from (285g/day) on un-treated sorghum chaff to (328.75g/day) on urea treated sorghum chaff. An increase in the level of maize offals in the treated diets increased the intake which is an indication of positive effect of treatment and supplementation. The result tallies with Finangwai and Dafur (2014) who reported a significant ($p<0.05$) higher feed intake when 50% urea treated Acha straw was fed to growing Yankasa rams. This result was also in agreement with the findings of Adedeji *et al.,* (2014) who obtained a higher DMI (364g/h/day) when the authors fed concentrates with varying levels of corn cob and groundnut husk. The values 285.00g to 328.75g were lower than the values 334.41 to 340.62g/h/day revealed Ibhaze *et al*., (2014) who fed ensiled corn cob based diet. However, basal diet in itself alone is not sufficient to meet the animal's maintenance and production requirements. Thus, supplementation is necessary in order to meet the animal nutritional requirements as revealed Makkar, (2003). Fnangwai and Dafur (2014) reported a linear trend for the live weight gain with a significant improvement as aresult of inclusion of urea treated diets fed to Yankasa rams. The figure 33.56 – 62.89g/day recorded were lower than the value 109.32 – 160.67g/day as reported Alabi *et al.*,(2010) when the authors fed *Brachiaria decumbens* as a basal diets supplemented with sorrel seed (*Hibiscus sabdariffa)* to Yankasa rams. On the other hand, the values 33.56-62.89g/day obtained were higher than the values (49.04g) and (52.98g) as revealed Ajayi *et al., (*2014) who fed concentrate diets with corn cob at varying inclusion levels. The result of this study on general trends revealed that, weight gain increases with increased levels of the concentrate (maize offal), because treatment four (T_4) had the highest level of supplement recorded and the highest values of mean weight gain. This could also have been attributed to the ensiled material used and an accompanying improvement in the utilization of nitrogen (protein source) in the 4% urea treated sorghum chaff as reported by Sa'adullah *et al*., (1981). Daily Water Intake was not significantly ($p>0.05$) different among rams fed urea treated sorghum chaff supplemented with maize offal as: 2.57, 2.67, 3.38 and 3.61 lit/h/day for T_1, T_2, T_3 and T_4 respectively. This is in concord with the report of Ajiji *et al*., (2013) who fed Gamba grass hay supplemented with *Fadherbia albida pod* and reported an average daily water intake of rams within 2 – 3 lit/h/day. The values T_1 (2.57ltr), T_2 (2.67ltr), T_3 (3.38ltr) and T_4 (3.61) obtained were lower than values 4.4 to 7.1 litter/day as revealed Daniel (2007), although the authors opined that the increased in water intake could havebeen attributed to hot and drier weather.

Table 3: Nutrient Digestibility of Yankasa Rams fed Urea Treated Sorghum Chaff (UTSC) Supplemented with Maize Offal

Parameters	**Treatments**				
	T1	**T2**	**T3**	**T4**	**LSD**
Dry Matter Digestibility%	54.50	56.24	68.05	72.68	1.972*
Crude Protein Digestibility%	79.18	84.92	86.02	87.82	0.067*
Crude Fiber Digestibility%	51.32	52.71	53.73	54.66	3.46^{ns}
Nitrogen Free Extract digestibility%	51.39	64.51	47.51	67.00	5.149*
Ether Extract Digestibility %	68.82	83.06	74.11	85.05	3.145*

LSD = Least Significant Difference
ns = Not Significant
* = Significant ($P<0.05$)

Table 3 presents the digestibility pattern of the rams. FAO, (1995) classified digestibility of feed as high (>60%), medium (40 - 60%) and low (<40%). In this study, high digestibility of feed was recorded especially at T_4 with 72.68%. The DM, CP, CF, NFE and EE digestibility showed significant variation ($p<0.05$) across the treatments. The high digestibility recorded could be due to higher quantity of supplement and the ensiled diets which influenced microbial protein synthesis and facilitated fermentation and consequently improved intake and digestibility. This is also in agreement with the report of Quala *et al.,* (2011) that the activity of ruminant microbes is improved by presence of nitrogen. The Crude protein digestibility (CPD) were significantly ($P<0.05$) different, the values range from 79.18 - 87.82% with the highest at T_4 (87.82%) while the least value of 79.18% was recorded in rams fed T_1 (UTSC, only). The result of this study is lower than the findings of Fajemisin *et al.*, (2012) who reported higher digestibility values of 84.92 to 86.02%. The crude fiber digestibility (CFD) was not significantly ($P>0.05$) different among the treatments and that the values 54.66% with rams fed T_4 (UTSC + 200 gram Maize offal) recorded the highest CFD while the least CFD value of 51.32% was recorded in rams fed T_1 (UTSC only). The values 51.32and 54.66% recorded were within the values 52.70% to 53.7% reported by Nyako *et al.,* (2012). The lower digestibility values recorded in the control (T_1) could be attributed to the lower CP content of the un-supplemented diet. The Nitrogen Free Extract digestibility (NFED) of the rams was significantly ($P<0.05$) different among treatments but within the range of 51.39 - 67.00% reported by Fajemisin *et al.,* (2012) when the authors fed cassava peels substitute with *Cajanuscajan* hay.

Table 4: Nutrient Intake Of Yankasa Rams fed Urea Treated Sorghum Chaff (UTSC) Supplemented with Maize Offal

Parameters	Treatments				
	T1	T2	T3	T4	LSD
DMI (g/h/d)	121.23	131.76	158.52	180.84	69.80*
OMI (g/h/d)	112.95	122.74	147.69	168.48	13.20*
CPI (g/h/d)	7.32	18.82	22.65	25.83	2.56^{ns}
CFI (g/h/d)	37.90	41.19	49.65	6.54	3.42^{ns}
Ash (g/h/d)	8.28	9.02	10.83	12.36	5.24*

Table 4 shows the DMI values with range of 121.23 - 180.48 g/h/day. This range is lower than the values 226.6 - 441.9g as reported by Nyako *et al*., (2012) who fed Gamba grass hay and supplemented with cowpea vines. The CPI values 17.32 - 25.83g/h/day were within the values 25.2% to 51.7g/h/day as revealed by Nyako *et al.*, (2012) where the authors fed Gamba grass hay and supplemented with cowpea vines. The CFI values of 37.90 to 56.54% were higher than the values 24.65 - 28.95% (Adamu *et al*., 2013). This finding falls within the figures obtained by Yohanna and Halilu, (2012) who recorded values ranging from 787.60 - 2404.83g/h/day, this also confirmed that supplementation with maize offal showed significant increase of the DMI. The OMI 112.95 to 168.48g/h/day recorded in this study did not agree with 209.4 - 411.7g/h/day as previously reported by Nyako *et al., (*2012).

4. CONCLUSION

Ensiled Urea Treated Sorghum Chaff has tendency of increasing crude protein content of poor quality crop residues mostly fed to ruminants semi-arid environment of Nigeria as revealed in this research, ensiling a Urea Treaated Sorghum Chaf have increased the CP content of the basal diet and supplementation with maize offals improved the dry matter intake, live weight gain, nutrient intake and digestibility of Yankasa rams.

5. RECOMMENDATION

Supplementation with 200g maize offal with urea treated sorghum chaff (UTSC) as Basal diet has significant effect on the performance of Yankasa rams as revealed by the highest dry matter intake (328.75g/h/day) and highest live weight gain (62.89g/day) for maintenances and production requirements of the rams in this research. However, further research can be done using other levels of maize offals.

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