The Kumbotso Teacher Educator (KUTEJ): A Journal of Multidisciplinary Studies
Vol 8.1 January 2017 **ISSN: 1597-8796**

THE NUTRIENT INTAKE AND GROWTH PERFORMANCE OF GROWING YANKASA RAMS FED DIETS CONTAINING DIFFERENT PROPORTIONS OF UREA TREATED RICE STRAW AND GAMBA HAY

Nayawo, A.A.,[1] Ehoche, O.W.,[2] Abdu, S.B.,[3] Otaru, S.M.,[2] and Mijinyawa M.A.[1]
[1]Department of Agricultural Education, Sa'adatu Rimi College of Education, Kumbotso, Kano
[2]National Animal Production Research Institute, Ahmadu Bello University, Zaria, Nigeria
[3]Department of Animal Science, Ahmadu Bello University, Zaria, Nigeria

Abstract

A ninety-day feeding trial was conducted to investigate the nutrient intake and growth performance by growing Yankasa rams fed diets containing different proportions of urea treated rice straw and gamba hay. Twenty four intact growing Yankasa rams of mean liveweight of 15.77±2.5 kg and aged 6 – 8 months were used for the study. The animals were balanced for weight and allotted into four dietary treatments with six (6) animals per treatment in a Completely Randomized Design. Urea treated rice straw and gamba hay proportions of 0:60, 20:40, 40:20 and 60:0 were used as basal diets. A concentrate diet consisting of maize grain, cotton seed cake, rice milling waste, wheat bran, bone meal and salt was formulated to contain 15 % crude protein. The animals were fed basal diets ad libitum while concentrate was fed at 1.5% of individual body weight. Data generated were subjected to analysis of variance. Differences in means were compared using Duncan's Multiple Range Test. The results revealed that animals fed 60:0 UTRS:gamba hay diet had significantly (P<0.05) higher dry matter intake, crude protein intake, neutral detergent fibre Intake and average daily gain compared to other treatments. Animals placed on 60:0 UTRS:gamba hay diet had the lowest (P<0.05) feed conversion ratio value indicating that animals on diet containing 60:0 UTRS: gamba hay were more efficient in converting feed to live weight gain than animals fed other diets. It is concluded that growing Yankasa rams performed better on diet containing 60:0 UTRS: gamba hay in terms of dry matter intake and average daily gain hence it is recommended for better economic production.

Key words: Urea treated rice straw, Performance, nutrient intake, Yankasa rams

Introduction

In the Savannah zone of Nigeria, the basal diets of most ruminants in the dry season is based on crop residues and dry standing grasses and most of these feed resources are imbalanced in nutritional value and vary from year to year (Zemmelink, 1999). The natural rangeland serves as the major sources of forages for ruminants in Nigeria. Rangeland forages, however, decline in

both quality and quantity during the dry season, resulting in the low productivity of animals. Gamba grass is usually established as permanent pasture in most commercial ranches or smallholder farms. It can be cut as fresh feed or conserved as hay. Its crude protein content is moderate in young growth (7 - 10%) but declines rapidly with maturity (2 - 5%) (Agishi, 1985). Alli-Balogun (2010) reported CP, NDF and ADF contents of gamba hay as 3.76, 76.4 and 56.2%, respectively.

Rice straw, like other cereal crop residues, is a potential source of energy for ruminants. However, its potential as an energy source is limited because it is high in dietary fibre (>50%) and low in crude protein (2 - 7%) and mineral contents (0.02 - 0.16%) (Jung *et al*., 1993). One way in which the low nutritive value of rice straw could be improved is through treatment with urea. Ehoche (2002) reported that urea treatment of crop residues is acknowledged to improve the nutritional value of crop residues and other fibrous by-products and reduce feed cost and wastages with practical application at the smallholder level in developing countries. The author further stated that in the tropics, cereal crop residues, such as maize, sorghum, millet stover and rice straw were produced in large quantities and could be used as ruminant livestock feeds. It was reported by Parnich (1983) that information on the utilization of rice straw in the diets of sheep is scanty. The use of rice straw could help to improve ruminant livestock production if its nutritive value is enhanced. The study therefore aimed at evaluating the value of different proportions of urea treated rice straw and gamba hay on feed intake and growth performance of growing Yankasa rams.

Materials and Methods

The study was conducted at the Livestock Farm of the Department of Agricultural Education, Sa'adatu Rimi College of Education, Kumbotso, Kano State, Nigeria. Kano lies on longitude 9°30' and 12°30' North and latitude 9°30' and 8°42' East on an elevation of 468m. It has a mean daily temperature range of 30°C to 33°C and annual rainfall ranges between 787 and 960 mm (KNARDA, 2001).

Experimental animals and management

Twenty four intact Yankasa rams aged 6 – 8 months with a mean liveweight of 15.77±2.5 were used for the study. Prior to the commencement of the experiment, the rams were given prophylactic treatments, consisting of intramuscular application of Oxytetracycline and Vitamin B complex at the dosage of 1ml/10 kg body weight of the animal. They were drenched with 1ml/10 kg body weight of Albendazole® and treated against ectoparasites with 0.5 ml/10 kg body weight of Ivomec®. The animals were ear-tagged for identification and quarantined for a period of 6 weeks. Adequate feed and clean fresh water were provided to them *ad libitum*.

Processing rice straw and gamba hay

Rice straw (*Oryza sativa* L.) was chopped manually to a particle length of 3-5 cm. It was treated by dissolving 4.0 kg urea in 50 litre of water and sprinkled on 100 kg rice straw (Schiere *et al.*, 1988) and mixed manually. Thereafter, the chopped rice straw materials were stacked for 14 days under air tight condition in PICS (Perdue Improves Cowpea Storage) sacks. The treated rice straw materials were left open for three (3) days which allowed ammonia gas to escape before being fed to the experimental animals. Gamba hay was also chopped to a particle size similar to that of the rice straw. The treated rice straw and chopped gamba hay were then packed and stored in sacks before being used for the animal feeding trial.

Experimental treatments, design and feeding animals

The dietary treatments consisted of urea treated rice straw (UTRS) and gamba hay (*Andropogon gayanus*) proportions of 0:60, 20:40, 40:20 and 60:0. A concentrate diet consisting of maize grain, cotton seed cake, rice milling waste, wheat bran, bone meal and salt was formulated to contain 15 % crude protein. The animals were balanced for weight and randomly assigned to four dietary treatments with 6 animals per treatment in a Completely Randomized Design. Experimental animals were housed in individual pens of 2m x 1m dimension equipped with feeding and watering facilities. The pens were cleaned and disinfected before the onset of the experiment. The animals were individually fed experimental diets. Basal diet was offered *ad libitum* while concentrate diet was fed at the rate of 1.5 % body weight individually throughout the feeding trial. The feed offered was adjusted at regular intervals of two weeks along with

changes in body weight. Fresh water was provided *ad libitum* throughout the period of the experiment, which lasted for 90 days.

Data collection

Daily records of feed intakes were taken by weighing the feed offered and the leftover (orts) the following day in the morning. The daily intake of feed was estimated for each animal by subtracting the feed leftover from the quantity offered to the individual animals. The weight of individual animals was measured at the onset of the trial after an overnight fasting by withdrawing their feed and water from 7.00 pm to 8.00 am to obtain their initial weights and subsequently at 2-week intervals throughout the feeding trial. Weight gain was determined by subtracting the initial weight from the final weight within the feeding period.

Chemical analysis

Feed samples were analyzed for proximate composition by the procedure of A.OA.C. (2007). Neutral Detergent Fibre (NDF), Acid Detergent Fibre (ADF) and Acid Detergent Lignin (ADL) were analyzed by the Method of Van Soest *et al.* (1991).

Statistical analysis

The data generated were subjected to analysis of variance (ANOVA), using the General Linear Model Procedure of SAS (2001). Duncan's Multiple Range Test was adopted to separate the means where significant differences existed (Duncan, 1955).

Results and Discussion

Table 2 presents the chemical composition of urea treated rice straw, proportions of urea treated rice straw and gamba hay, untreated rice straw and concentrate mixtures used in the study. The results indicated that urea treatment increased the CP content of the rice straw from 3.64% in the untreated rice straw to 8.89% after treatment with urea. This result is in agreement with the findings of Puri and Gupta (2001), who reported that CP content of rice straw increased from 3.40 % in untreated to 8.04% in urea treated straw. Several authors have also reported increases in the CP content of cereal straws as a result of urea treatment (Promma *et al.*, 1994 and Chetna Bhatt *et al.*, 2004). The increase in the CP content of treated rice straw is associated with the

conversion of urea into ammonia during the treatment period part of which may have been organically bound with treated straw (Chetna Bhatt *et al*., 2004). As a result of urea treatment, the NDF content was reduced to 67.98 % from 72.16 %. Similarly, the ADF and ADL contents of untreated rice straw were reduced from 43% and 11.23% in untreated rice straw to 41.35% and 8.57% respectively in urea treated rice straw. The reduction in NDF content of urea treated rice straw from 72.16 to 67.98 % observed in this study was comparable to earlier reports (Chetna Bhatt *et al*, 2004 and Midau *et al*., 2015). The decrease in NDF content was due to the solubilization of the hemicelluloses content during the treatment of straw and its subsequent removal from cell wall constituents (Givens *et al.*,1988 and Chetna Bhatt *et al*., 2004). The observed decrease in ADL content by urea treatment could be ascribed to the breakdown of lignocellulose bond through ammonium hydroxide (NH_4OH) formation in the stack during treatment, as ascertained by Punj *et al*. (1977). Rehrahie (2001) reported that most data reviewed have shown decreased fibre fractions and a considerable increase in crude protein contents of crop residues due to urea treatment. The CP content of 2.69% was obtained for gamba hay (0:60 UTRS:gamba hay). The NDF, ADF and ADL contents of gamba hay recorded were 79.59, 38.56 and 10.78 %, respectively. The CP content of 2.69% obtained for gamba hay in this study was lower than the 3.50% CP of gamba hay reported by Alli-Balogun (2010). The NDF content of gamba hay (70.59 %) was also lower than the 75.95% obtained by Alli-Balogun (2010) and the 76.4% obtained by Lufadeju (1988). Similarly, the value of ADF obtained in this study was lower than the 56.2% reported by Lufadeju (1988). The differences in values may be attributed to variation in soil fertility, maturity or time of harvest, leaf to stem ratio, cultivar, curing and method of processing, which affect the chemical composition (Lambert and Litherland, 2000; Ajiji *et al*., 2013). Crude protein contents of 4.75 and 6.83 % were obtained for 20:40 UTRS:gamba hay and 40:20 UTRS: gamba hay, respectively. The NDF, ADF and ADL content were obtained for 20:40 UTRS: gamba hay were 75.72, 40.49 and 10.04 % while the content of NDF, ADF and ADL for 40:20 UTRS:gamba hay were 61.17, 71.85, 40.42 and 9.30 %, respectively. The crude protein, NDF, ADF and ADL contents of concentrate mixtures were 14.89, 38.46, 19.88 and 6.29 %, respectively.

The results showed that DMI through roughage was significantly higher ($P<0.05$) in animals fed diet containing 60:0 UTRS :gamba hay than in those fed 40:20 UTRS: gamba hay diet, which value was higher ($P<0.05$) than those fed 20:40 UTRS: gamba hay diet. Animals fed 0:60 UTRS:

gamba hay diet had the least (P<0.05) value. The significantly higher TDMI observed in animals fed diets containing urea treated rice straw hay could be due to the increased availability of nutrients as a result of urea treatment. The urea treatment of poor quality roughages has been reported to improve feed utilization by enhancing rumen microbial synthesis, thereby increasing forage degradation and voluntary intake (Lufadeju *et al*., 1985). The significantly higher (P<0.05) TDMI in animals fed diets containing urea treated rice straw may be a reflection of the increased palatability and digestibility of the straw. Mc Donald *et al*. (1995) observed that there is a positive relationship between digestibility and feed intake. Chenost and Kayouli (1997) also attributed feed intake to the improved palatability and softening effect of urea treatment on rice straw. Concentrate DMI, TDMI and TDMI per metabolic weight followed the same trend. It was observed that the CPI for animals fed diet containing 60:0 UTRS:gamba hay was significantly higher (P<0.05) followed by those on 40:20 UTRS:gamba hay diet whose value was higher (P<0.05) than that of animals fed 20:40 UTRS:gamba hay diet. Least (P<0.05) value was obtained in animals fed 0:60 UTRS:gamba hay diet. There was no significant difference (P>0.05) between the NDFI for animals on 60:0 and 40:20 UTRS:gamba hay diets but differed significantly (P<0.05) compared to those fed 0:60 UTRS:gamba hay diet. Lowest (P<0.05) was obtained for animals on 20:40 UTRS:gamba hay diet. The CP and NDF intakes observed in animals fed diets containing urea treated rice straw might be attributed to the higher crude protein and nutrient detergent fibre digestibility. The higher CPI values obtained in animals fed diet containing higher proportions of urea treated rice straw was in conformity with Narayan *et al*. (2004) who found a higher CP intake when urea treated wheat straw was fed to goats and lactating buffaloes.

Animals on diet containing 60:0 UTRS:gamba hay had the highest (P<0.05) total weight gain and daily gain while least (P<0.05) value was obtained for animals on diet containing 0:60 UTRS:gamba hay. Animals fed 60:0 UTRS:gamba hay diet had the least (P<0.05) FCR value compared to those on 0:60 UTRS:gamba hay diet. The significantly higher total weight gains and daily weight gains in animals fed diets containing 60:0 and 40:20 UTRS:gamba hay compared to those fed 20:40 and 0:60 UTRS:gamba hay diets might be due to increased dry matter intake and nutrient utilization. Puri and Gupta (2001) reported that improvement in gain was directly related to the dry matter intake. The results agree with what was reported by Finangwai and Dafur (2015) that treatment of acha straw with urea had a positive effect on weight gain. The increased

total weight gain and average daily gain could be due to increased nitrogen availability in the digestive tract for the effective degradation of straw. The least feed conversion ratio (FCR) value obtained indicated that animals on diet containing 60:0 UTRS:gamba hay were more efficient in converting feed to live weight gain than the animals fed other diets.

Table 1: Composition of concentrate mixtures fed experimental animals

Ingredients	(%)
Maize	20
Rice mill waste	19
Wheat bran	35
Cotton seed cake	25
Bone meal	0.5
Salt	0.5
Total	100
Calculated CP (%)	15
ME (Kcal/kg)	2753

CP=crudeprotein, ME=metabolizable energy

Table 2: Chemical composition of Experimental diets

Parameters	UTRS: GH 0:60	UTRS:GH 60:0	URS 100	UTRS: GH 20:40	UTRS: GH 40:20	CONC
DM	90.78	91.11	93.58	90.89	91.00	92.76
OM	89.20	88.54	90.72	88.98	89.00	85.88
CP	2.69	8.89	3.64	4.75	6.83	14.89
NDF	79.59	67.98	72.16	75.72	70.85	38.46
ADF	38.56	41.35	43.10	40.49	40.42	19.88
ADL	10.78	8.57	11.23	10.04	9.30	6.29

UTRS=urea treated rice straw, GH=gamba hay, URS= untreated rice straw, CONC=concentrate , DM=dry matter, OM=organic matter, CP=crude protein, NDF= neutral detergent fibre, ADF=acid detergent fibre, ADL=acid detergent lignin

Table 3: Effect of different proportions of urea treated rice straw and gamba hay on feed intake and weight gain of growing Yankasa rams

	Proportions of UTRS and gamba hay (%)				
Parameters	0:60	20:40	40:20	60:0	SEM
DMI (g/day)					
Roughage	263.11^{d}	277.73^{c}	314.06^{b}	325.01^{a}	9.21
Concentrate	247.67^{d}	253.03^{c}	276.41^{b}	295.18^{a}	4.52
Total DMI	510.78^{d}	530.76^{c}	590.47^{b}	620.19^{a}	10.32
Total DMI/kg$W^{0.75}$	64.57^{d}	67.10^{c}	74.65^{b}	78.20^{a}	0.46
CP Intake (g/d)	13.74^{d}	25.21^{c}	40.33^{b}	55.13^{a}	0.53
NDF Intake (g/d)	406.53^{c}	401.89^{d}	418.35^{a}	421.60^{a}	3.54
Initial weight (kg)	15.77	15.77	15.77	15.83	0.31
Final weight (kg	19.76^{d}	20.73^{c}	21.80^{b}	22.95^{a}	0.31
Total wt. gain (kg)	4.00^{d}	4.97^{c}	6.02^{b}	7.18^{a}	0.65
ADG (g/d)	44.44^{d}	55.18^{c}	66.85^{b}	79.81^{a}	6.25

FCR(g/DMI/gain)	11.49[a]	9.62[b]	8.83[c]	7.77[d]	0.73

[a,b,c,d=] Means with different superscripts across the rows differed significantly (P<0.05), UTRS=urea treated rice straw, SEM=standard error of means, ADG= average daily gain, FCR=feed conversion ratio, DMI=dry matter intake, NDF=neutral detergent fibre, CP=crude protein,

Conclusions and Recommendation

From the results obtained, it is concluded that animals fed 60:0 and 40:20 UTRS:gamba hay diets compared favourably with animals placed on 20:40 and 0:60 UTRS:gamba hay diets in terms of intake and growth performance indices. The study revealed that urea treated rice straw has the potential of meeting the nutritional needs of growing rams in terms of nutrient requirement and can, therefore, be used as suitable roughage feed material during feed scarcity for improving the performance and productivity of small ruminant livestock.

References

Agishi, E.C. (1985). *Forage resources of Nigeria rangelands*. In Adu, I.F. Osinowo, O.A., Taiwo, B.B.A. and Alhassan, W.S. Proceedings of National Conference on Small Ruminant Production, Zaria, Nigeria. Edited by. Pp 115-140 NAPRI, Zaria. pp 115–124.

Ajiji, I., Nyako, H.D., and Ashom, S.A. (2013). Performance of Yankasa Rams Fed *Andropogon gayanus* (Gamba Grass) Hay Supplemented with *Faidherbia albida*Acacia) Pods *Journal of Biology, Agriculture and Health care*, *l3*(13), www.iiste.org ISSN 2225-093X (Online).

Alli-Balogun, J.K. (2010). Effect of exogenous enzyme treatment on the nutritional value of Gamba hay (*Andropogon gayanus*, Kunth, fed to cattle. Ph. D Thesis. Deparment of Animal Science, Ahmadu Bello University, Zaria, Nigeria. Pp123.

AOAC. (2007). Association of Official. Analytical Chemists, Washington DC.

Chenost, M. and Kayouli, C. (1997). Roughage Utilization in Warm Climates. FAO Animal and Health Paper 135. Rome.

Chetna Bhatt, R.S., Jaiswal, T.C. and Joshi, Y.P. (2004). Effect of urea treated baled wheat straw based diets on the performance of crossbred heifers. *Indian Journal of Animal Nutrition* 21:236-239.

Dias-da-Silva, A.A., and Guedes, C.V.M. (1990). Variability in the nutritive value of straw cultivars of wheat, rye and triticale and response to urea treatment. *Animal Feed Science Technology* 28, 79-89.

1. DUNCAN, D.B. (1955). MULTIPLE RANGES AND MULTIPLE F- TESTS *BIOMETRIC*S, 11:1-420.

Ehoche, O.W. (2002). Feeding strategies for improving milk production. in: Fanimo, A.O. and Olanife, J.A. (Eds) contributory role of animal production in national development.

Proceedings of the 7th Annual Conference of the Animal Science Association of Nigerian (ASAN), Abeokuta, Nigeria. Pp.19-26.

Givens, D.I., Adamson, A.H. and Cobby, J.M. (1988). The effect of ammoniation on the nutritive value of wheat, barley and oat straws: Digestibility and EnergyValue Measurements *in vivo* and Their Prediction from Laboratories Measurements. *Journal of Animal Feed Science and Technology* 19 (1-2): 173-184.

Jung, H.G., Buxton, D.R., Hatfield, R.D. and Ralph, J. (1993). Forages cell wall structure and digestibility. American Society for Agronomics, Wisconsin, USA.

KNARDA (Kano Agricultural and Rural Development Authority) (2001). *Metrological Station Reports Temperature Record Book and Management Unit* No. 11:1-3

Lambert, M.G., and Litherland, A.J. (2000). A practitioner's guide to pasture quality. *Proceedings of the New Zealand Grassland Association, 62*, 111–115.

Lufadeju, E.A., Blacket, G.A. and Orskov, E.R. (1985). The effect of variety of spring barley straw and ammonia treatment on nutritive value. *Proceedings of Nutrition Society,* 44:96.

Lufadeju, E.A. (1988). Evaluation of improving utilization of mature Gamba hay *(Andropogon gayanus)* by Friesian-Bunaji heifers. Ph D. Thesis. Deparment of Animal Science, Faculty of Agriculture. Ahmadu BelloUniversity, Samaru, Zaria, Nigeria. Pp 116.

McDonald, R.A., Greenhalgh, J.F.D. and Morgan (1995). Animal Nutrition (5th edition). Pearson Education Limited, Edinburg gate. Garlow Essex CM2O 2JE, United Kingdom.

Midau, A., Mubi. , A.A. and Kwaji, Z. (2015). Evaluation of chemical composition of treated and untreated rice straw using urea. *Scientific Journal of Animal Science.*Vol. 4(12) (2015). www.sjournal.com/index.php/SIAS/issues/view/458.

Narayan, D., Sharma, K. and Naulia, U. (2004). Nutritional evaluation of Lentil straw and urea treated wheat straw in goats and lactating buffaloes. *Asian-Australian Journal of Animal Science* 17(11):1529-1534.

Parnich, T. (1983). Urea-ensiled rice straw as a feed for cattle in Thailand. S*outh African Journal of Animal Science* 133.

Promma, S., Tasaki, I., Cheva-Isarakul, B. and Indratula, T. (1994). Effect of feeding neutralized urea treated rice straw on milk production of crossbred Holstein cows. *Asian-Australian Journal of Animal Science,* 7: 493-498.

Punj, M.L., Sharma, K.O. and Bhatia, I.S. (1977). Action of Sodium hydroxide on wheat straw. *Indian Journal of Dairy Science* 30:160-161.

Puri, J.P. and Gupta, B.N. (2001). Effect of feeding rice straw treated with two levels of urea and moisture on growth and nutrient utilization in crossbred calves. *Indian Journal of Animal Nutrition,* 18: 54 – 59.

Rehrahie, M. (2001). Biological and Economical Evaluation of Urea Treated Teff and Barley Straw Based Diets to Crossbred Dairy Cows in the Highlands of Ethiopia Swedish University. Uppsala, Sweden. Msc Thesis. Pp. 1-12 (II).

SAS. (2001). Procedure Guide version 9.1. Statistical Analysis Systems Institute, Cary, NC. Schiere, J.B., Nell, A.J. and Ibrahim, M.N.M. (1988). Feeding of urea-ammonium treated rice straw. WORLD ANIMAL REVIEW, 65: 31-42.

Van Soest, P.J., Robertson, J.B., and Lewis, B.A. (1991). Methods for dietary fibre, neutral detergent fibre and non-starch polysaccharides in relation to animal nutrition. *Journal of Dairy Science, 74*(10), 3583–3597.

Zemmenlink, G. (1999). Utilization of poor quality roughages in Northern Guinea savanna Zone. A paper presented at the proceeding of the International symposium on Animal production in the topics held at University of Ibadan 26th –29th March 1973. Edited by J.K. Loosli, V.A. Oyenuga and G.M. Babatunde (1999), Printed by Heinaman Educational Book Nigeria PLc. Ibadan Nigeria,