

Intake and Growth Performance of Fattening Yankasa Rams Fed Diets Containing Different Proportions of Urea Treated Rice Straw and Gamba Hay

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Abstract

Ninety days feeding trial was conducted to investigate the nutrient intake and growth performance of fattening Yankasa rams fed diets containing different proportions of urea treated rice straw and gamba hay. Twenty intact fattening Yankasa rams of mean liveweight of 21.87 ± 2 kg and aged 12 – 18 months were used for the study. Animals were balanced for weights and allotted into four dietary treatments with five (5) 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 13 % crude protein. The animals were fed basal diets ad libitum while concentrate was fed at 2% 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, fattening Yankasa rams performed better on diet containing 60:0 UTRS:gamba hay in terms of dry matter intake and average daily gain hence recommended for better economic production.

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

Target audience: Nutritionists, Extension specialists, livestock farmers, feed millers

INTRODUCTION

Description of Problem

Nigeria was estimated to have a population of 41.3 million sheep, 72.5 million goats and 19.5 million cattle (FMARD, 2016). Small ruminant rearing in Nigeria like in any other place are

important in supporting the livelihoods of poor resource farmers throughout developing world. Valuable contribution of small ruminants is income generating assets among smallholder livestock farmers (Shittu *et al.*, 2008). It was reported by Fasae *et al.* (2012) that production of small ruminants is limited among other factors by inadequacy of year round feed availability. 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 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. The crude protein content of gamba grass 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 straws could be improved is through treatment with urea. Ehoche (2002) reported that, urea treatment of crop residues is acknowledged to improve 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 straws could help 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 fattening Yankasa rams.

MATERIALS AND METHODS

Site of the study

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 12 – 18 months with mean liveweight of 21.87±2 kg 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. The animals 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 the animals *ad libitum*.

Processing of 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 animal feeding trial.

Experimental treatments, design and feeding of 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 13 % crude protein. Animals were balanced for weight and randomly assigned to four dietary treatments with 5 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 2.0 % 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. 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 weeks 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.O.A.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). Means that were significantly different, Duncan's Multiple Range Test (DMRT) was used to compare them (Duncan, 1955).

Table 1: Composition of concentrate mixture for fattening Yankasa ram

Ingredients	(%)
Maize	25
Rice mill waste	27
Wheat offal	30
Cotton seed cake	17
Bone meal	0.5
Salt	0.5
Total	100

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 fattening Yankasa rams

Parameters	Proportion of UTRS:gamba hay (%)				SEM
	0:60	20:40	40:20	60:0	
DMI (g/day)					
Roughage	445.51 ^d	66.92 ^c	548.43 ^b	594.61 ^a	19.00
Concentrate	421.43	428.14	438.75	441.37	25.07
Total DMI	866.94 ^d	895.06 ^c	987.18 ^b	1035.98 ^a	27.01
TDMI/kgW ^{0.75}	85.75 ^d	89.95 ^c	97.64 ^b	102.37 ^a	0.44
CP intake	105.94 ^d	112.87 ^c	127.64 ^b	135.21 ^a	0.58
NDF Intake	620.03 ^c	616.79 ^c	644.73 ^b	655.33 ^a	3.96
Initial Wt. (kg)	21.86	21.40	21.86	21.88	0.51
Final Wt. (kg)	25.28 ^d	25.62 ^c	28.68 ^b	30.34 ^a	0.32
Wt. gain (kg)	3.42 ^d	4.22 ^c	6.82 ^b	8.46 ^a	0.73
ADG (g)	38.00 ^d	47.44 ^c	64.55 ^b	72.89 ^a	5.96
FCR(gDM/g gain)	22.81 ^a	18.87 ^b	15.29 ^c	14.21 ^d	0.95

a,b,c,d: Means with different superscripts along the row differed significantly (P<0.05), UTRS=urea treated rice straw, TDMI= total dry matter intake, CP=crude protein, NDF=neutral detergent fibre, wt. =weight, ADG=Average daily gain, FCR=feed conversion ratio, SEM=standard error of means,

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 CP content of cereal straws as a result of urea treatment (Promma *et al.*, 1994 and Chetna Bhatt *et al.*, 2004). The increase in CP content of treated rice straw is associated with the conversion of urea into ammonia during 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 solubilization of hemicelluloses content during 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 (NH₄OH) 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. 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 76.4% obtained by Lufadeju (1988). Similarly, the value of ADF obtained in this study was lower than 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 %, respectively 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.

Effect of different proportions of urea treated rice straw and gamba hay on feed intake and weight gains of fattening Yankasa rams is presented in Table 3. The results show significant ($P<0.05$) differences for dry matter intake, final weight gain and weight gain. Roughage dry matter intake was significantly higher ($P<0.05$) in rams fed diet with 60:0 UTRS:gamba hay than in rams on 40:20 UTRS:gamba hay diet which value was significantly higher ($P<0.05$) than rams fed 20:40 UTRS:gamba hay. Least ($P<0.05$) value was recorded in rams fed 0:60 UTRS:gamba hay. Total dry matter intake and crude protein intake followed the same trend. The significantly higher total dry matter intake in fattening rams fed diets containing urea treated rice straw may be a reflection of increased palatability and digestibility of the straw. Mc Donald *et al.* (1995) observed that there is positive relationship between digestibility and feed intake. Chenost and Kayouli (1997) also attributed feed intake to improved palatability and softening effect of urea treatment on rice straw. The authors further reported that urea treatment increase intake of rice straw in the range of 15 to 50 %. The present result is also in agreement with the report of Finangwai *et al.* (2008) that urea treatment of straw increased feed intake in crossbred bulls. Significant difference ($P<0.05$) was obtained in the values of neutral detergent fibre intake. Neutral detergent fibre intake value for rams fed diet containing 60:0 UTRS:gamba hay was significantly higher ($P<0.05$) than those on 40:20 UTRS:gamba hay whose value was higher ($P<0.05$) than for those fed

diets containing 20:40 UTRS:gamba hay and 0:60 UTRS:gamba hay whose values were similar ($P>0.05$). The increase in CP and NDF intake observed could be due to better digestibility of the nutrients. Total weight gain and average daily gain were significantly higher ($P<0.05$) in rams fed 60:0 UTRS:gamba hay followed by those fed 40:20 and 20:40 UTRS:gamba hay diets with least ($P<0.05$) value in rams fed diet containing 0:60 UTRS:gamba hay. Higher total weight gain and average daily gain in groups fed roughage containing urea treated rice straw could be due to increased nitrogen availability in the digestive tract for effective degradation of straw with subsequent increase in dry matter intake. The result is in line with the findings of Saadullah *et al.* (1982), Puri and Gupta (2001) and Finangwai and Dafur (2015). Significant differences ($P<0.05$) among the treatments were observed for feed conversion ratio. Rams fed 60:0 UTRS:gamba hay had the least ($P<0.05$) value (14.21) compared to 22.81, 18.87 and 15.29 for rams on 0:60, 20:40 and 40:20 UTRS:gamba hay respectively. Feed conversion ratio improved in rams fed diets containing urea treated rice straw. Rams on diet containing 60:0 UTRS:gamba hay had significant ($P<0.05$) effect having 37.7 % improvement in conversion compared to the rams fed 0:60 UTRS:gamba hay diet, indicating 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.

Conclusions

From the result 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 dry intake and growth performance indices. Therefore it is concluded that, urea treated rice straw can be used as a suitable roughage feed material during feed scarcity in fattening Yankasa rams.

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