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# Effect of different levels of urea treated Gamba hay on growth performance of Yankasa rams

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***Target Audience:*** Small-scale livestock farmers, Students, Scientists

## Abstract

*Twenty four (24) Yankasa yearling rams were used to determine the effect of feeding high levels of urea treated gamba hay (Andropogon gayanus). The rams aged 15 – 18 months with an average weight of 22 .45kg were randomly allocated to one of four dietary groups, rams in group A served as control and were offered untreated gamba hay at 2.5% of their body weight while rams in groups 2, 3 and 4 where offered 5%, 6% and 7% urea treated gamba hay respectively at 2.5% of their body weight for 90 days. All rams had equal access to water, salt lick blocks and concentrate fed at 2.0% of their body weight. Data was collected daily on feed intake, while live body weight changes and body condition score were measured weekly. Dry matter composition of the gamba hay offered declined as the level of urea treatment increased, the crude protein content of the diets also increased as the level of urea treatment increased. However the values of NDF and ADF declined as the level of urea treatment increased. Rams fed 6% and 7% treated gamba hay had significantly the highest total dry matter intake while rams fed untreated gamba hay had significantly (P<0.05) the lowest weight gain. There was no significant (P>0.05) difference in the weight gains of rams fed 6% and those fed 7% urea treated gamba hay and the rams in both groups had significantly (P<0.05) the highest weight gains. Rams fed the 6% urea treated gamba hay had the best FCR. It can be concluded that 6% &7% urea treated gamba gave similar performance but 6% had the better feed conversion ratio and is more cost effective.*

***Key words:*** Urea treated gamba hay, cost effectiveness

## Description of Problem

In the tropics, most ruminants are fed on poor quality straws, hays, or agricultural crop-residues and industrial byproducts (1). These feedstuff are characterized by low levels of Crude Protein and high level of structural polysaccharides, which drastically limits the dry matter intake, digestion and ultimate performance (2) thereby supplying insufficient nutrients not even enough for maintenance of the animals. Efforts have been made in different parts of the world to improve the nutritional quality of straws, using various treatment such as direct ammonization process and sodium hydroxide treatment. Both treatment methods had poor adoption rates from farmers due to several reasons and are being replaced with urea treatment. Urea treatment is capable of breaking the ligno-hemicellulosic bonds in straw and increases palatability and digestibility, crude protein (CP) and energy content resulting in increased straw intake, growth rate and the milk yield of the animals. Most research work conducted on

urea treatment of straws used between 3% and 5% urea. (3) studied the effect of physical form and urea treatment of rice straw on rumen fermentation, microbial protein synthesis and nutrient digestibility. They concluded that 3% urea treatment of rice straw improved feed intake. (4) conducted a study using 4% urea treated gamba hay, they concluded that treating maize stover with urea, was sufficient to support maintenance plus small live weight gains in cattle, while (5) also conducted a study using various combinations of rice straw and gamba hay, they also concluded that 4% urea treated rice straw can be used as a suitable roughage feed material during feed scarcity in fattening Yankasa rams. However, there is a paucity of data on utilization of higher levels of urea treated crop residue, hay or gamba, consequently this study seeks to investigate the effect of feeding rams 6% and 7% urea treated gamba hay.

**Materials and Method**

***Location:*** The study was carried out at the experimental farm of College of Agriculture and Animal Science Ahmadu Bello University in Kaduna. Kaduna is located in the Southern Guinea Savannah zone (latitude 10'' 30' – 10" 34'N and longitude 7" 45'-7" 75'E) (3).The trial took place during the hot and dry months of February to April.

***Animal Management***: Twenty four Yankasa yearling rams were purchased and quarantined in a holding pen for a period of 4weeks during which they were given prophylactic doses of antibiotics (Tetracycline LA) and dewormed (Ivomec®) according to manufacturer's instructions. During this period they were given 3% urea treated hay in addition to concentrate of 16.75% CP (Table 1).

***Experimental Design***: The rams aged 15 – 18 months with an average weight of 22kg were randomly allocated to one of four dietary groups balanced for live weight, each dietary group consisted of three rams each and was replicated twice. Rams in group A served as control and were offered untreated *Andropogon gayanus* hay at 2.5% of their body weight while rams in groups 2, 3 and 4 where offered 5%, 6% and 7% urea treated hay respectively at 2.5% of their body weight for 90 days. All rams had equal access to water, salt lick blocks and concentrate (fed 7.30am and 4.30am daily) at 2.0% of their body weight.

***Urea Treatment of Gamba hay***: Gamba hay was chopped into smaller pieces (3-5cm) using forage chopper. The chopped gamba hay was treated with urea at 5%, 6% and 7%, for every 100kg of Gamba hay 5kg, 6kg or 7kg urea was dissolved in water at using 5litres water per kg of urea. After spreading the gamba hay on a polythene sheet, a knapsack sprayer was used to spray the urea solution onto the gamba hay and turned over several times to ensure equal distribution and thorough mixing. The treated gamba hay was then ensiled for 14 days, after which it was opened for a few hours before being fed to the rams.

***Data collection:*** Daily records of feed intake were taken by weighing the feed offered and the leftover the following day in the morning. The daily intake of feed was estimated for each animal by subtracting the feed leftover from the quantity initially offered to the individual animals. Weight of individual animals was measured at the onset of the trial after 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 (6). Neutral Detergent Fibre (NDF), Acid Detergent Fibre (ADF) and Acid Detergent Lignin (ADL) were analyzed by the Method of (7).

***Statistical analysis*:** The data generated were subjected to analysis of variance (ANOVA) using the General Linear Model Procedure of (8). Significant means were separated using Duncan's Multiple Range Test (DMRT) of same statistical package.

The following model was used
$Yij = \mu + Gi + eij$
where
$Yik$ = dependent variable,
$\mu$ = over all mean,
$G_i$ = effect of $i^{th}$ level of urea (0, 5, 6, 7%)
$e_{ij}ik$ = random error.

**Results and Discussions**

Chemical composition of Gamba hay fed to experimental rams is shown on Table 2. Dry matter composition of the gamba hay offered declined as the level of urea treatment increased, the crude protein content of the diets also increased as the level of urea treatment increased. However the values of NDF and ADF declined as the level of urea treatment increased while the values of the Ether extract and that of Ash didn't show any observable trend.

The observable decline in dry matter as the level of urea increases could be due to the quantity of water used in urea dissolution while treating gamba hay. Urea treatment increased the crude protein content of gamba hay through generation of ammonia which was incorporated into the hay in the form of nitrogen. (9) also observed increased values of crude protein after urea treatment. NDF and ADF values declined as the level of urea treatment increased is probably as a result of solubilization of hemicelluloses and its subsequent removal from cell wall constituents ((10) and (9)) thereby reducing the ADF and NDF fractions. The reduction in NDF and ADF content of urea treated gamba hay observed in this study was comparable to earlier reports (9) and (11). The general improvement of the nutrient status of gamba hay observed agrees with (12) who reported that, urea treatment of crop residues improves nutritional value of crop residues and other fibrous by-products. (13) 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

Table 3 shows the performance of rams and cost implications on various levels of urea treated hay. There was no significant ($P>0.05$) difference in the intake of concentrate across the different dietary treatment, although rams fed on 7% urea treated hay had higher numerical concentrate intake. However rams fed 6% and 7% urea treated hay had similar DMI and this was significantly ($P<0.05$) the highest intake of hay compared to rams fed other diets.

Concentrate provided was highly digestible and palatable as evidenced by manner and rate at which all the rams consumed the concentrate. Rams fed 6% and 7% urea treated hay had higher and similar DMI of hay probably because it was more palatable and had higher level of digestibility resulting from greater breakdown action of ammonium hydroxide on hemicellulose bonds within fibers of gamba hay. This is similar to results reported by (3) for rice straw but contrary to the results obtained by (4) who reported that rams fed urea treated gamba hay had a slight but not significant increase in dry matter intake compared to rams fed untreated. Differences in results might be attributed to experimental animals.

Rams fed untreated gamba hay had significantly ($P<0.05$) the lowest weight gain. There was no significant ($P>0.05$) difference in the weight gains of rams fed 6% and those fed 7% urea treated gamba hay and rams in both groups had significantly ($P<0.05$) the highest weight gains compared to rams fed 0% and 5% urea treated gamba hay.

Rams fed 6% and 7% urea treated gamba hay had the highest and similar weight gains probably because they had consumed hay which had higher amounts of urea therefore was more palatable and had greater amounts of ammonium hydroxide breaking down hemicellulose bonds in gamba hay resulting in higher feed digestibility and greater nutrient availability compared to rams fed other diets. Furthermore ruminal microbes in rams fed 6% & 7% urea treated hay probably had more liberated nitrogen for protein synthesis and consequently more microbial protein absorbed at the abomasum.

Feed conversion ratio varied from 27.46 for rams fed untreated gamba hay diet and 11.62 for rams fed 6% urea treated gamba hay. Rams fed 6% urea treated gamba hay had the best feed conversion ratio probably on account of the higher weight gained recorded, apparently those fed 7% urea treated gamba hay consumed more quantities of fed to gain less resulting in lower FCR.

Body condition score ranged from 2.0 for rams fed untreated gamba hay to 3.5 for rams fed the 6% and 7 % urea treated hay. There was no significant difference between the body condition score of rams fed the 6%or 7% urea treated gamba hay.

Rams fed the 6% or 7% urea treated hay having similar BCS probably reflects similarity in the ease of digestion and assimilation of nutrients from the urea treated gamba hay consumed.

The cost of the feed fed to rams increased as the level of urea treatment increased from 0% (₦112.14) to 7% (₦1036.33). This is a direct result of the additional cost of adding more urea to the diets.

The cost of feed per gain also increased as the level of urea increased, rams fed the untreated gamba hay had the lowest cost feed per gain while rams fed the 7% urea treat gamba hay had the highest cost of feed per gain. Rams fed untreated gamba hay required ₦2.88 for every gram of weight gained while rams fed the 6% urea treated hay required ₦7.26 and the rams fed 7% urea treat hay required ₦ 10.97 for every gram of weight gained.

**Conclusion and Application**

1. Rams fed the 6% and 7% urea treated hay had similar and significantly the highest weight gains while rams fed the 6% urea treated gamba hay had the best feed conversion ratio,
2. Feed cost was lower with 6% urea treatment and therefore potentially the most profitable.
3. From the result of this study, treatment of poor quality gamba hay with urea at 6% is recommended for smallholder livestock farmers for better performance and cost effectiveness.

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**Table 1:** Composition of concentrate fed to rams

| Item | Percentage |
|---|---|
| Maize | 15 |
| Maize Offal | 25 |
| Brewers spent grains | 20 |
| Groundnut cake | 10 |
| Palm Kernel Cake | 25 |
| Salt lick | 5 |
| Total | 100 |
| Calculated Analysis | |
| Crude Protein | 16.75 |
| Energy K/kcal | 250,155 |

**Table 2:** Chemical composition of Gamba hay fed to rams

| Parameters | Urea treatment levels | | | |
|---|---|---|---|---|
| | 0% Urea | 5% Urea | 6% Urea | 7% Urea |
| Dry matter | 98.3 | 96.4 | 93.8 | 89.0 |
| Crude Protein | 3.6 | 11.3 | 14.05 | 17.7 |
| NDF | 73.9 | 68.8 | 62.05 | 57.5 |
| ADF | 38.4 | 34.9 | 31.25 | 30.5 |
| Ash | 7.05 | 6.89 | 6.45 | 6.75 |
| EE | 1.69 | 2.10 | 1.89 | 1.65 |

**Table 3** Performance of rams and cost implications on various levels of urea treated hay

| | 0% Urea | 5% Urea | 6%Urea | 7%Urea | SEM |
|---|---|---|---|---|---|
| Initial weight (kg) | 24.50 | 24.60 | 24.95 | 25.0 | 0.80 |
| Final weight (kg) | 28.00 | 30.60 | 33.80 | 33.50 | |
| Weight gain (kg) | 3.50$^{c}$ | 6.00$^{b}$ | 8.85$^{a}$ | 8.50$^{a}$ | 0.75 |
| Av daily gain (g) | 38.88$^{c}$ | 66.67$^{b}$ | 98.33$^{a}$ | 94.44$^{a}$ | 18.3 |
| DM intake conc.(g/day) | 485.00 | 493.00 | 510.00 | 520.00 | 20.3 |
| DM intake Hay.(g/day | 583.00$^{b}$ | 604.00$^{b}$ | 633.00$^{a}$ | 650.01$^{a}$ | 22.8 |
| Total daily DM intake | 1,068.00$^{b}$ | 1,097.00$^{b}$ | 1,143.00$^{a}$ | 1,171.00$^{a}$ | 24.3 |
| FCR (TDMI/gain) | 27.46 | 16.45 | 11.62 | 12.39 | |
| Body Condition Score | 2.00$^{c}$ | 3.00$^{b}$ | 3.50$^{a}$ | 3.50$^{a}$ | 0.25 |
| Cost of feed per kg (N) | 105.00 | 365.00 | 625.00 | 885.00 | |
| Cost of feed per day (N) | 112.14 | 400.40 | 714.30 | 1036.33 | |
| Cost of feed per gain (N/g) | 2.88 | 6.00 | 7.26 | 10.97 | |