

Evaluation of Growth Performance in Uda Rams Fed A Silage Mixture of *Pennisetum Pedicellatum* and *Ziziphus Mauritiana* Leaves

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ABSTRACT

A feeding trial was conducted to assess the effects of graded replacement of groundnut hay (GNH) with an ensiled blend of *Pennisetum pedicellatum* (PD) and *Ziziphus mauritiana* leaves (ZM) on growth performance of Uda rams. Five isonitrogenous diets were formulated; thus, D1 (100% GNH, control) and D2–D5, in which 25, 50, 75, and 100% of the GNH was substituted with the ensiled ZM–PD mixture, respectively. All animals received a standard supplement made up of crushed maize, cottonseed cake, wheat offal, and cowpea husk at 30, 40, 25, and 5% inclusion levels, respectively. Twenty rams weighing between 20.00 and 21.01 kg were randomly allotted to five treatments in a completely randomized design with four replicates per treatment over an 80-day feeding trial. The animals were fed a daily ration of 67% basal diet and 33% concentrate mixture. Data on daily feed intake (DFI), weight gain, and feed conversion ratio (FCR) were collected. The results showed that dietary treatment significantly ($P < 0.05$) influenced all parameters. Rams fed diet D5 had the highest DFI (732.18 g), comparable to D4 (717.44 g), D3 (694.77 g), and D1 (674.33 g), but significantly higher than D2 (658.02 g). Daily weight gain was greatest in D5 (107.33 g) and D4 (95.25 g), similar to D3 (83.11 g), while D1 (76.09 g) and D2 (74.36 g) performed the poorest. FCR was significantly improved in D5 (6.80) and D4 (7.53), which were comparable to D2 (8.85) and D3 (8.36), but superior to D1 (8.86). The study concludes that an ensiled mixture of *Pennisetum pedicellatum* and *Ziziphus mauritiana* leaves can completely replace groundnut hay as a basal diet for Uda rams with enhanced growth performance.

Keywords: Silage, *Ziziphus mauritiana*, *Pennisetum pedicellatum*, growth performance, Uda Rams.

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1. INTRODUCTION

Northern Nigeria has considerable potential to meet the nation's animal protein needs through ruminant livestock production. According to Ibrahim *et al.* (2025), the country has an estimated population of livestock as follows; 20.9 million cattle, 49.1 million sheep, 88.2 million goats, and 9.2 million pigs. Despite this overwhelming statistics, domestic meat output from these and other species falls short of national demand. A recent report indicates that 65% of the livestock consumed in Nigeria is imported. (Daily Nigerian, 2026). This predicament is largely attributed to inadequate supply of animal feeds.

Feed supply during the rainy season has never been a challenge, ruminants graze on natural pastures and legumes. However, dry season brings a scarcity of such forages, leaving animals dependent on Crop residues that are both difficult to digest and nutritionally deficient. According to Essien and Udoh (2021), cost of feeding constitutes up to 60–80% of total livestock production costs. Although supplementary feeding with cereal grains, oilseed meals, and by-products can enhance basal diets, these ingredients are extremely expensive for resource-poor farmers. Feed deficit, coupled with producers' efforts to sustain their herds, has fueled persistent farmer–herder conflicts throughout West Africa (Tobias *et al.*, 2026). A panacea to this challenge lies in improving the nutritional value of existing feed supplies for use during the dry season. Ensiling abundant green herbage and fodder produces silage of high quality through controlled anaerobic fermentation (Ntakyo *et al.*, 2020).

The provision of adequate feed during the dry season persists as a major obstacle to productive ruminant livestock farming in Northern Nigeria. Considering the problems of poor feed quantity

and quality driven by erratic rainfall, global warming, declining soil fertility, rising insecurity, and high fertilizer costs, achieving food security in the northeastern sub-region, and by extension Nigeria, there is a need to explore sustainable means of making available year-round nutritious livestock feed. A viable strategy to achieve this is the ensilage and subsequent feeding of a *Ziziphus mauritiana*–*Pennisetum pedicellatum* leaf mixture to Uda rams. However, published research on this approach is scarce, underscoring the need for the present investigation.

2. MATERIALS AND METHODS

2.1 Study Area

This experiment was carried out at the Livestock Farm, Federal Polytechnic, Damaturu. Located in the semi-arid zone of Nigeria, the area lies within the geographical coordinates of 11° 44' 49.1856" N and 11° 57' 58.2912" E. Damaturu has a tropical continental climate, characterized by a short rainy season between June and August and a prolonged dry period lasting from October to May. Similarly, Mean annual temperatures range between 14.4°C and 43°C, with an average yearly rainfall of approximately 560 mm (Weather Spark, 2026).

2.2 Experimental Animals and Management

Twenty (20) Uda rams, with individual body weights ranging from 20.05 to 21.01 kg, were acquired from the Sunday market in Damaturu, Yobe State. The animals were housed intensively in a well-ventilated thatched pen, with individual tethering at 2-meter intervals. Prior to the feeding trial, the rams underwent a two-week quarantine period, during which they were dewormed and treated for ectoparasites with Ivermectin® injection (1ml/40 kg body weight). In addition, each animal received an intramuscular dose of oxytetracycline at 1ml/10 kg live weight. Routine

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husbandry practices were also observed throughout the study to ensure adequate feeding and optimal hygiene.

2.3 Source of Test Materials and Feed Ingredients

Fresh foliage of *Ziziphus mauritiana* and *Pennisetum pedicellatum* was harvested from the arable farmlands of the Polytechnic while other feedstuffs which include; wheat offal, cowpea husk, cotton seed cake, maize, and salt lick, were procured from Damaturu.

2.4 Ensiling the Mixture of *Ziziphus mauritiana* leaves and *Pennisetum pedicellatum*

The plant materials were gathered and chopped into 2–3 cm fragments. They were allowed to wilt for 24 hours, mixed in a 1:1 ratio, and subsequently ensiled in hermetic bags. Each bag was layered sequentially: 1.5 kg of the chopped mixture was introduced, sprinkled with a molasses solution (1 litre of molasses to 25 litres of water), and compacted using a wooden pestle. One litre of the molasses solution was used for

every 10 kg of silage material. This layering process was repeated until the bag was filled to 90% capacity, after which it was securely tied to maintain airtight conditions. The bags were then stored in a rodent-proof location for 30 days to allow fermentation to complete. Although the ensiled material was not monitored for pH, the process was successful as the finished silage did not spoil or develop moulds.

2.5 Experimental Diet Formulation

Five basal diets (D1–D5) containing various replacement levels of ensiled ZM&PD for groundnut hay were compounded. Similarly, a concentrate supplement made up of cottonseed cake, wheat offal, crushed maize, and cowpea husk at 40, 25, 30, and 5% respectively was formulated. Diet D1 served as the control, containing 100% groundnut hay. Other diets; D2, D3, D4, and D5, had respective levels of 25%, 50%, 75%, and 100% ZM&PD as replacement for groundnut hay (Table 1). Chemical composition of experimental diets is presented in Table 2.

Table 1: Ration Composition of Experimental Diets and Levels of Concentrate Mix Fed to Uda Rams

Ingredient Composition	DIETS				
	D1 (Control)	D2 (25% ZM&PD)	D3 (50% ZM&PD)	D4 (75% ZM&PD)	D5 (100% ZM&PD)
Basal Diet (%)					
Groundnut Hay	100.00	75.00	50.00	25.00	0.00
Ensiled ZM & PD Foliage	0.00	25.00	50.00	75.00	100.00
Concentrate Mix (%)	33.00	33.00	33.00	33.00	33.00
<i>Cottonseed Cake</i>	40.00	40.00	40.00	40.00	40.00

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<i>Wheat Offal</i>	25.00	25.00	25.00	25.00	25.00
<i>Crushed Maize</i>	30.00	30.00	30.00	30.00	30.00
<i>Cowpea Husk</i>	5.00	5.00	5.00	5.00	5.00
Total Diet (%)	100.00	100.00	100.00	100.00	100.00
Supplements	Salt Lick ad-libitum	Salt Lick ad-libitum	Salt Lick ad-libitum	Salt Lick ad-libitum	Salt Lick ad-libitum
Quantity Offered (kg/head/day)	3.00	3.00	3.00	3.00	3.00

Table 2: Chemical Composition of Experimental Diets

Parameter	DIETS				
	D1 (Control)	D2 (25% ZM&PD)	D3 (50% ZM&PD)	D4 (75% ZM&PD)	D5 (100% ZM&PD)
Dry Matter (DM) %	88.50	87.20	85.90	84.60	83.30
Crude Protein (CP) %	15.80	16.30	16.80	17.30	17.80
Crude Fibre (CF) %	28.50	26.40	24.30	22.20	20.10
Ether Extract (EE) %	2.40	2.60	2.80	3.00	3.20
Ash %	8.20	8.60	9.00	9.40	9.80
Nitrogen-Free Extract (NFE) %	45.10	45.90	47.10	47.90	49.10
Calculated ME (Mcal/kg DM)	2.45	2.51	2.57	2.63	2.69

2.6 Experimental Design and Feeding

The experimental animals were randomly allotted to the five dietary treatments in replicates of four, in a completely randomized design. The basal diet was offered at 2% body weight per ram per

day, supplemented with a concentrate mix at 1% of body weight per head per day. This was carried over a 80-day feeding period. Clean water, *ad libitum*, was supplied to rams throughout the trial.

2.7 Data Collection

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Individual body weights were first recorded at the beginning of the trial using a 100-kg scale to establish baseline values. Weekly weighings were then carried out to track weight changes. Daily feed intake was calculated by offering a known quantity of feed and deducting the weight of leftovers collected after 24 hours. Feed Conversion Ratio was calculated using the relationship; Daily feed intake/ daily weight gain.

2.8 Chemical Analysis

Analyses of the proximate composition of the experimental diets were conducted in accordance with the AOAC (2005) official procedures.

2.9 Statistical Analysis

Data were subjected to one-way analysis of variance (ANOVA) using SPSS version 25. Treatment means were compared and separated using Duncan's Multiple Range Test (DMRT) at a significance threshold of 5% (Duncan, 1955).

3. RESULTS AND DISCUSSION

3.1 Performance of Uda Rams Fed Ensiled *Ziziphus mauritiana* Leaves and *Pennisetum pedicellatum* mixture

The performance responses of Uda rams to graded levels of ensiled *Ziziphus mauritiana* leaf–*Pennisetum pedicellatum* mixture are shown in Table 3. Except for initial body weight, dietary treatment had a significant effect on all parameters ($P < 0.05$).

Feed intake was highest in rams on D5 (732.18 g), which was statistically comparable to D4

(717.44 g), D3 (694.77 g), and D1 (674.33 g), but significantly greater than D2 (658.02 g). These values are higher than the 314–326 g range reported by Jinadu *et al.* (2024) in West African Dwarf Rams fed a basal diet with graded energy levels of concentrate and Adebisi *et al.* (2023) who reported 184.29– 256.1 g in West African Dwarf rams fed guinea grass hay.

Daily weight gain followed a similar pattern, with T5 (107.73 g) and T4 (95.25 g) recording significantly higher values than T1 (76.09 g) and T2 (74.36 g), while T3 (83.11g) occupied an intermediate position. These values are somewhat similar to 103.57 reported by Oluwadele *et al.* (2024) in African Dwarf rams fed silage made from *Pennisetum purpureum* and other selected farm residues.

Final body weight was significantly higher in D4 (28.63 kg) and D5 (29.62 kg), which were statistically similar, compared to D1 (26.02 kg) and D2 (26.62 kg). Rams on D3 (27.13 kg) performed comparably to other groups. Total weight gain mirrored this trend, with D5 (8.62 kg) and D4 (7.62 kg) showing the highest gains, similar to D3 (6.65 kg), and significantly outperforming D1 (6.09 kg) and D2 (5.95 kg).

Feed conversion ratio (FCR) was significantly improved as the proportion of the ensiled ZM and PD mixture increased, with D4 (7.53) and D5 (6.80) recording lower/better values than the control (8.86). These values are poorer than 4.41 - 5.00 reported by Unah *et al.* (2025) in WAD rams fed cabbage waste ensiled with other feeding stuff.

Table 3: Growth Indices of Uda Rams Fed a Mixture of Ensiled *Ziziphus Mauritiana*

Leaves and *Pennisetum Pedicellatum*

Index	Diet					SEM
	D1	D2	D3	D4	D5	
Initial body weight (kg)	20.05	20.67	20.48	21.01	21.00	1.14 ^{NS}
Daily feed intake (g)	674.33 ^{ab}	658.02 ^b	694.77 ^{ab}	717.44 ^{ab}	732.18 ^a	18.09 [*]
Daily weight gain (g)	76.09 ^b	74.36 ^b	83.11 ^{ab}	95.25 ^a	107.73 ^a	6.17 [*]
Final body weight (kg)	26.14 ^b	26.62 ^b	27.13 ^{ab}	28.63 ^a	29.62 ^a	0.83 [*]
Body weight change (kg)	6.09 ^b	5.95 ^b	6.65 ^{ab}	7.62 ^a	8.620 ^a	0.42 [*]
Feed conversion ratio	8.86 ^c	8.85 ^{ab}	8.36 ^{ab}	7.53 ^a	6.80 ^a	0.32 [*]

a, b. = Means within the same row with different superscripts letters differ significantly (P <0.05). SEM = Standard Error of Mean, NS = Not significant.

4. CONCLUSION

The results of this study indicate that ensiled mixtures of *Ziziphus mauritiana* leaves and *Pennisetum pedicellatum* can effectively replace groundnut hay in the basal diet of growing Uda rams. Increasing the proportion of the ensiled mixture, particularly at the 75% and 100% replacement levels, was associated with improved feed intake, body-weight gain, final body weight, and feed conversion ratio under the conditions of the present study. Further studies involving larger sample sizes, detailed nutritional characterization, and economic evaluation are recommended to confirm the practical value of this feeding strategy.

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