

UTILIZATION OF ENSILED *Spondia mombin* (HOG PLUM) LEAVES BY WEST AFRICAN DWARF SHEEP

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ABSTRACT

Seasonal feed shortages in tropical Nigeria pose challenges to ruminant production, with feed costs comprising 60-70% of expenses. This study assessed the chemical composition and utilization of ensiled *Spondias mombin* leaves as an alternative feed for West African Dwarf (WAD) sheep. Twelve (12) WAD sheep (10-12 kg) were assigned to four (4) diets in a 90-day trial using a completely randomized design: T1 (20% concentrate + 80% SMNAD, no additive), T2 (20% concentrate + 80% SMGNC, groundnut cake), T3 (20% concentrate + 80% SMPKC, palm kernel cake), and T4 (20% concentrate + 80% SMWHO, wheat offal). Chemical composition showed significant ($P<0.05$) variations: dry matter (40.23-56.82%), crude protein (13.98-18.01%), crude fiber (13.87-18.32%), ether extract (3.23-4.13%), ash (10.32-12.98%) and nitrogen-free extract (52.31-54.27%), respectively. Fiber fractions differed: neutral detergent fiber (59.89-62.81%), acid detergent fiber (30.21-33.18%) and acid detergent lignin (11.00-15.01%), respectively. Performance metrics revealed that SMGNC-fed sheep had the highest ($P<0.05$) dry matter intake (689.20 g/d), weight gain (6.35 kg), average daily gain (70.55 g/d), and best feed conversion ratio (9.77). Ensiled *Spondias mombin* with groundnut cake offers a viable, cost-effective dry-season feed to improve ruminant productivity.

Keywords: *Spondias mombin*, ensiling, WAD sheep, nutrient composition, utilization

DESCRIPTION OF PROBLEM

Livestock production in tropical regions like Nigeria faces seasonal feed shortages, particularly during the dry season (November-March), leading to reduced animal performance and low productivity. Feed costs, accounting for approximately 60–70% of ruminant production expenses, exacerbate these challenges, especially during the dry season when scarce forage increases costs and reduces profitability [1]. As a result of this any fluctuation in feed availability directly impacts the overall production costs. This seasonality creates a pronounced gap between the supply and demand of animal protein in the market, which not only affects the livelihood of farmers but also exacerbates the challenges of food security in the region [2]. Therefore, there is a need to source alternative livestock feedstuffs that are cheap, readily available, and not compete by man and industry to sustain livestock production in Nigeria. According to [3], utilizing non-food

parts from agricultural products as animal feed will not only enhance food security but also contribute to alleviating environmental problems associated with their disposal. *Spondias mombin* (Hog plum) popularly known as Igi Iyeye in Yoruba is a fructiferous tree which belongs to the *Spondias* genus of the flowering plant family *Anacardiaceae*, a nutrient-rich tree that offers a promising solution as it provides year-round leaves that can be ensiled to preserve quality and enhance palatability [4];[5]. Ensiling is a well-established method of forage conservation that involves the fermentation of green forage under anaerobic conditions to produce silage and ensuring consistent nutrient supply [6]. Ensiling with additives like groundnut cake, palm kernel cake, or wheat offal may improve fermentation and nutritional value [6]. However, data on its use for West African Dwarf (WAD) sheep is limited. This study evaluated the chemical composition and performance effects of ensiled

Spondias mombin-based diets on WAD sheep to inform sustainable feeding strategies.

MATERIALS AND METHODS

Study Location and Sample Preparation

The experiment was conducted at the Sheep and Goat Unit of the Teaching and Research Farm, College of Agriculture and Hospitality Management, Tai Solarin University of Education, Ijagun, Nigeria (7°15' N, 3°40' E), with tropical climate (25-33°C, 1200-2400 mm rainfall).

Sample collection

Mature *Spondias mombin* leaves were harvested, chopped (1-2 cm), wilted for 24 hours, and mixed with additives (4:1 ratio) for ensiling in sealed 65-liter basins for 42 days.

Experimental Design and Feeding

Twelve (12) WAD sheep (10-12 kg, 5-6 months) were housed individually and assigned to four (4) treatments (n=3) in a completely randomized design. Diets were fed 3% body weight + 20% extra for 90 days. Intake, weight gain, and feed conversion ratio (FCR) were measured.

T1: 20% concentrate + 80% SMNAD (no additive), T2: 20% concentrate + 80% SMGNC (groundnut cake), T3: 20% concentrate + 80% SMPKC (palm kernel cake), T4: 20% concentrate + 80% SMWHO (wheat offal)

Silage Making

Chopped *Spondias mombin* leaves were wilted for 24 hours. Leaves were mixed with additives (GNC, PKC, WHO & NAD) at a 4:1 ratio, then packed into 65-liter plastic basins compacted with a 25-kg sand-bag for anaerobic fermentation. Silages fermented for 42 days at ambient temperature (25–33°C) and were sampled for chemical analysis [7].

Chemical and Statistical Analysis

Dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE), ash, and nitrogen-free extract (NFE) were determined by AOAC (2023). Fiber fractions (NDF, ADF, ADL) as described by [8]. Data were analyzed using one-way analysis of variance (ANOVA) with SPSS software. Significant treatment means were separated using Duncan's Multiple Range Test ($P < 0.05$).

RESULTS AND DISCUSSION

Chemical Composition

The chemical composition of experimental diets as shown in Table 1 varied significantly ($P < 0.05$) across treatments. The dry matter (DM) content ranged from 40.23% in silage without additives (SMNAD) to 56.82% in silage with wheat offal (SMWHO). The higher ($P < 0.05$) DM in SMWHO indicates that wheat offal reduces moisture, concentrating nutrients and improving silage quality. This finding aligns with [9] and [10], who noted increased DM with high-fiber additives in ruminant silages. Crude protein (CP) content varied significantly ($P < 0.05$), with the highest value (18.01%) in silage with groundnut cake (SMGNC) and the lowest (13.98%) in SMNAD. These results agree with [7], who reported a CP of 20.12% in silage with groundnut cake. All CP values exceed the 7% minimum recommended for ruminant productivity [11], suggesting these silages support animal growth. Crude fiber (CF), ether extract (EE), and ash content also showed significant variations ($P < 0.05$). Crude fibre (CF) ranged from 13.87% in SMGNC to 18.32% in SMNAD, indicating additive influence on fiber content. Despite higher CF potentially reducing digestibility, the elevated CP ensures a balanced nutrient profile for ruminants. Ether extract (EE), representing fat, ranged from 3.23% in silage with palm kernel cake (SMPKC) to 4.13% in SMGNC, which supports energy needs during high production. Ash content, reflecting minerals, was highest ($P < 0.05$) (12.98%) in SMPKC and lowest (10.32%) in SMGNC, comparable to 11.50–12.80% in water hyacinth silage with additives [7]. Higher ash content enhances mineral availability, vital for animal health [12]. Neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL) varied significantly ($P < 0.05$), ranging from 59.89% to 62.81% (NDF), 30.21% to 33.18% (ADF), and 11.00% to 15.01% (ADL) in SMGNC and SMPKC, respectively. The NDF values align with the 60.00% limit for adequate ruminant forage intake [13]. These findings indicate that ensiled *Spondias mombin*, especially with groundnut cake or wheat offal, offer improved nutrient content, making them a stable,

high-quality feed for ruminants in Nigeria's dry season.

Table 1: Chemical composition (%) of experimental Diets

Diets	DM	CP	CF	EE	Ash	NDF	ADF	ADL
SMNAD	40.23 ^c	13.98 ^d	18.32 ^a	3.31 ^b	11.88 ^c	61.35 ^c	32.54 ^b	32.54 ^c
SMGNC	54.01 ^b	18.01 ^a	13.87 ^c	4.13 ^a	10.32 ^c	59.89 ^d	30.21 ^c	11.00 ^d
SMPKC	53.10 ^b	15.03 ^b	16.42 ^b	3.23 ^b	12.98 ^a	62.81 ^a	33.18 ^a	15.01 ^a
SMWHO	56.82 ^a	14.10 ^c	16.10 ^b	3.63 ^b	11.90 ^b	60.35 ^c	32.69 ^b	14.12 ^b
SEM	1.10	2.00	2.00	0.5	1.05	0.22	0.15	0.02

^{a,b,c,d}= means on the same column with different superscripts differed significantly ($p < 0.05$) SMNAD= Spondiamombin (no additives); SMGNC= Spondiamombin groundnut cake silage; SMPKC= Spondiamombin palm kernel cake silage; SMWHO= Spondiamombin wheat offal silage, SEM=standard error of mean.

Growth performance characteristics of WAD Sheep fed ensiled *Spondiamombin* leaves

The growth performance of West African Dwarf (WAD) sheep fed ensiled *Spondias mombin* leaf with various additives is presented in Table 2. Significant ($P < 0.05$) differences were observed among treatment means for all measured parameters. Daily dry matter intake (DMI) varied significantly ($P < 0.05$), with sheep fed silage with groundnut cake (SMGNC) recording the highest intake at 689.20 g/d, followed by wheat offal silage (SMWHO) at 605.30 g/d. The lowest ($P < 0.05$) DMI was observed in silage without additives (SMNAD) at 501.38 g/d. These results suggest that groundnut cake enhances palatability, encouraging higher feed intake. This aligns with [11], who reported a DMI of approximately 700 g/d for sheep fed high-protein silage, confirming that protein-rich additives like groundnut cake boost intake. Final weight gain also showed significant ($P < 0.05$)

differences, with the SMGNC group achieving the highest final weight (19.35 kg) and total weight gain (6.35 kg), compared to the lowest ($P < 0.05$) gain (4.11 kg) in the SMNAD group. The average daily gain was highest in SMGNC (70.55 g/d) versus SMNAD (45.67 g/d), highlighting groundnut cake's role in promoting growth. Feed conversion ratio (FCR) varied significantly ($P < 0.05$), with SMGNC showing the best FCR (9.77), indicating efficient feed utilization, while the palm kernel cake group (SMPKC) had the poorest FCR (12.06). These findings are consistent with [11], who reported improved FCR in sheep fed high-protein diets, suggesting that protein-rich additives enhance feed efficiency and growth performance. These results demonstrate that *Spondias mombin* silage with groundnut cake significantly improves DMI, weight gain, and FCR in WAD sheep, making it a valuable feed option for ruminants in Nigeria's dry season.

Table 2: Growth performance characteristics of WAD Sheep fed *Spondias mombin* leaf ensiled with different additives

	Diet 1	Diet 2	Diet 3	Diet 4	
Parameters	SMNAD	SMGNC	SMPKC	SMWHO	SEM
DM intake (g/d)	501.38 ^c	689.20 ^a	403.25 ^d	605.3 ^b	10.05
Initial wt (kg)	14.00	13.00	13.00	14.00	2.00
Final wt (kg)	18.11	19.35	16.01	19.12	5.20
Wt gain (kg)	4.11 ^c	6.35 ^a	3.01 ^d	5.12 ^b	1.00
AD gain (kg)	45.67 ^c	70.55 ^a	33.44 ^d	56.89 ^b	3.00
FCR	10.98 ^b	9.77 ^d	12.06 ^a	10.64 ^c	1.00

^{a, b, c, d}= Means on the same row with different superscripts are significantly ($p < 0.05$) different, SMNAD= Spondiamombin (no additives); SMGNC= Spondiamombin groundnut cake silage; SMPKC= Spondiamombin palm kernel cake silage; SMWHO= Spondiamombin wheat offal silage; FCR= feed conversion ratio; SEM= standard error of the mean.

CONCLUSION AND APPLICATION

Ensiled *Spondias mombin* leaves with groundnut cake (SMGNC) significantly improve DM intake, weight gain, and FCR in WAD sheep. Farmers should adopt this for dry-season feeding to boost productivity. Further research on long-term effects and other additives is recommended.

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