PROXIMATE COMPOSITION OF ENSILED RICE STRAW AND GMELINA (*Gmelina arborea*) WITH MOLASSES AS ADDITIVES

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Abstract

This study examined the effect of varying levels of molasses inclusion on the nutrient composition and physical quality of silage prepared from rice straw and *Gmelina arborea* (50:50). Five treatments were formulated: 0% molasses (control), 5%, 10%, 15%, and 20% molasses, each replicated three times. Proximate analysis and physical evaluation were conducted before and after ensiling. Data was analyzed using a complete randomized design while means were separated using Duncan`s multiple range test. Results indicated that molasses addition enhanced crude protein (CP) content across all treatments, with the 15% molasses inclusion (Treatment 4) showing the highest CP value (10.65%). Although the 20% inclusion (Treatment 5) scored highest in physical attributes such as smell, colour, and texture, the laboratory analysis confirmed Treatment 4 as nutritionally superior. The findings suggest that 15% molasses inclusion optimizes both nutrient quality and storage stability of rice straw and Gmelina arborea silage. These results are significant for improving feed resources for ruminant livestock in regions facing seasonal feed shortages.

Keywords: Rice straw, *Gmelina aborea*, Ensiled, Molasses, Additives

Description of Problem

Sustainable livestock production relies on the continuous availability of adequate and high-quality feed resources. In tropical regions such as Nigeria, feed scarcity is common during the dry season, leading to nutritional stress and reduced animal performance [1]. Crop residues such as rice straw are abundant, given rice's global importance as a staple food crop, but their utilization is constrained by low nutritional value, high lignin content, and poor palatability. Likewise, browse species such as *Gmelina arborea* are potential feed resources, though their nutritive value is limited by phenolic compounds and tannins that reduce intake and digestibility [2]. Ensiling these materials will not only preserve the forages through controlled fermentation, it will also be a strategy to improve the feed value of these resources. Molasses is a rich source of soluble carbohydrates, and has been widely reported to enhance fermentation quality, crude protein retention, and palatability of silage [3]. Treatment of the forages with molasses may enhance its quality, nutritive value and palatability. Therefore, this study evaluated the proximate composition and physical quality of rice straw and *Gmelina arborea* ensiled with different levels of molasses inclusion.

Materials and Methods

The experiment was conducted at the Livestock Section of Samaru College of Agriculture, Division of Agricultural Colleges, Ahmadu Bello University, Zaria, Nigeria. The site is located within the Northern Guinea savannah ecological zone, with a mean annual rainfall of 700–1400 mm and temperatures ranging from 26–32°C. Rice straw and *Gmelina arborea* were harvested, wilted for 24 hours to reduce moisture content to approximately 70%, and chopped into 1–5 cm lengths. Five treatments were prepared: 0%, 5%, 10%, 15%, and 20% molasses inclusion. Three kilograms of forage were thoroughly mixed with the designated molasses level, packed into airtight plastic containers, compressed to expel air, sealed with polythene, and stored for three weeks. Upon opening, silages were subjected to

physical assessment (colour, smell, texture, and general observation), and samples were collected for proximate analysis. The physical assessment was carried out by visual examination and rated by independent scores while the proximate was carried out according to the procedure of AOAC [5].

Results and Discussion

Table 2 below indicates the physical assessment of rice straw and *Gmelina arborea* mixtures (50:50) after ensiling with molasses. The result shows that the inclusion of molasses improved the crude protein content of silage made from mixtures of rice straw and *Gmelina arborea* (50:50) across treatments. Treatment 4 (15% molasses) yielded the highest CP (10.65%), compared to 8.75% in the control. These results align with Woolford, [4], who reported that fermentable carbohydrates from molasses promote lactic acid fermentation, thereby enhancing protein preservation. Crude fibre content decreased with increasing molasses levels, suggesting improved digestibility, which agrees with Elghandour *et al* [3], who noted that additives enhance the utilization of low-quality roughages. The decrease observed in crude fibre as molasses increased maybe due to the improvement in microbial fermentation which results in increased degradation of the fibre content and thus lowering the overall fibre content.

Physical observations also revealed significant differences among treatments. The control (T1) was characterized by poor quality with a slimy texture and offensive odour, while molasses-treated silages were more appealing. Treatment 5 (20%) scored highest in sensory attributes, though its CP content (10.46%) was slightly lower than that of Treatment 4. This indicates that higher molasses inclusion may improve physical appearance but does not necessarily correspond to higher nutrient content. This aligns with the report of [6].

Table 1. Initial proximate composition of rice straw and *Gmelina arborea* mixtures (50:50) before ensiling.

Treatment	DM (%)	EE (%)	CP (%)	CF (%)	CHO (%)	Ash (%)
Rs x Ga	6.75	6.00	8.75	40.45	62.20	18.30

DM= dry matter, CP=crude protein, CF= crude fibre, EE= ether extract, CHO= carbohydrate, Rs/Ga = Rice straw and *Gmelina arborea.*

Table 2. Physical assessment of rice straw and *Gmelina arborea* (50:50) after ensiling with molasses.

Treatment	Observation	Colour	Smell	Texture
T1 (0%)	Going bad	Light brown	Offensive	Slimy
T2 (5%)	Good	Brown	Fairly pleasant	Soft
T3 (10%)	Good	Deep brown	Pleasant	Soft
T4 (15%)	Good	Dark brown	Very pleasant	Moderately firm
T5 (20%)	Excellent	Deep brown	Very pleasant	Very firm

Table 3. Proximate composition of rice straw and *Gmelina arborea* (50:50) after ensiling with molasses.

Treatment	DM (%)	EE (%)	CP (%)	CF (%)	CHO (%)	Ash (%)
T1 (0%)	5.25	5.70	8.75	20.40	60.15	20.15
T2 (5%)	5.05	5.80	10.50	19.25	60.00	18.65
T3 (10%)	7.05	7.70	10.54	18.55	53.26	21.45
T4 (15%)	4.75	5.00	10.65	19.15	56.80	22.80
T5 (20%)	8.30	5.40	10.46	18.74	58.94	16.90

DM=Dry matter, EE=Ether Extract, CP=Crude protein, CF=Crude fibre, CHO= carbohydrate

Table 4. pH and temperature values of rice straw and Gmelina arborea (50:50) silage with different molasses levels

Treatment	pH	Temperature(^{0}C)
T1 (0%)	6.50	25.22
T2 (5%)	5.08	26.03
T3 (10%)	5.57	25.55
T4 (15%)	5.60	27
T5 (20%)	5.15	26.65

pH= Potential Hydrogen

Conclusion and Application

This study revealed that 15% molasses addition enhanced crude protein content while maintaining desirable fermentation quality. Although 20% inclusion produced superior sensory properties, it did not surpass the 15% treatment nutritionally. Therefore, 15% molasses inclusion rate is recommended for farmers seeking to optimize silage quality. Future studies should focus on animal performance trials to validate the feeding value of the silage under practical production conditions.

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