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Performance and Digestibility of White Fulani Heifers Fed Banana Leaf Ensiled With Brewers Spent Grain and Poultry Waste

Okunlola, O. O*, Alalade, J. A, Adebisi, I. A, Egbinola, O. O

Department of Animal Production Technology, Oyo State College of Agriculture and Technology, P.M.B. 10, Igbo Ora, Oyo State, Nigeria

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***Corresponding author:** Okunlola, O. O

Abstract **Original Research Article**

The use of crop residues can bring benefits to the ruminant's diet and in many cases ensure an increase in food availability, improved production efficiency and an economic and appropriate disposal of these sub products. An experiment was carried out to determine the performance and digestibility of sixteen (16) White Fulani heifers fed banana leaf (BL) ensiled with cassava peel (CP), and varying levels of brewers spent grain (BSG) and poultry waste (PW). The animals were allotted into four (4) dietary treatments with four (4) replicates per treatment in a completely randomized design. Treatments consist of control: 40% BL + 60% CP , Treatment 1: 40% BL + 20% CP + 40% BSG, Treatment 2: 40% BL + 20% CP + 40% PW and Treatment 3: 40% BL + 20% CP + 20% BSG+ 20% PW. The results from the study showed that the dry matter intake (DMI), crude protein (CP)intake, neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) of the diets were significantly ($P< 0.05$) affected. The chemical composition of the silage fed to white Fulani heifers shows that the treatment were significantly affected cross the treatments. T2 had the highest value of dry matter (51.22) and control had the lowest value (27.16), T1 had the value of crude protein (25.55), NDF value (49.70), ADF (30.60) and ADL (14.50) while control had the lowest value (11.19). (29.60), (22.10) and (11.30) respectively. Mean dry matter digestibility of the experimental study shows that all parameters across dietary treatments were significantly affected ($p< 0.05$). T1 had the highest dry matter intake (526.91) and dry matter digestibility (67.05), while control had the lowest dry matter intake (233.44) and faecal output (96.86). T3 had the highest faecal putput (205.17). The performance indices of White Fulani heifers fed the experimental diets indicates that parameter across diets treatment were significantly affected ($p<0.05$). T1 had the highest values of feed intake (19.57), weight gain (17.02) and average weight gain (0.81), while T2 had the lowest values (5.88), (-6.23) and (-0.30) respectively. It was however observed that the values of all parameters showed no regular pattern with the highest value recorded in T1, and the lowest values in T2 which later increased in T3. From the study, silage with T1 in diet favoured feed utilization, increased intake, nutrient digestibility and better performance.

Keywords: White Fulani, digestibility, performance, banana leaf, brewers spent grain.

INTRODUCTION

Forages are the main source of feed for ruminants to meet their nutritional requirements, either for maintenance or production. Ruminants are generally faced with the period of feed scarcity during the dry season. The reduction in supply along with the low nutritional value of grasses in the dry season affects animal performance negatively and increase methane emissions from enteric fermentation, a concerning factor from today's environmental point of view. To minimize problems caused by seasonal pasture supply and reduce production costs, the use of agricultural residues in the diet of ruminants has been proposed. The use of crop residues can bring benefits to the ruminant's diets and in many cases ensure an increase in food availability, improved production efficiency and an economic and appropriate disposal of these sub products [1, 2]. In recent years, agro and industrial products/wastes e.g. poultry droppings, cassava peel, banana plant (stem and leaves), wet brewer's grain etc., have attracted the attention of nutritionists for their economical and nutritional potentialities in the feeding of animals [3]. Over the past 20 years there have been major advances in the technology of making and feeding silage [4]. Much of this development has occurred in temperate zones, and there are needs for further research in tropical zones, in areas such as manipulation of microbial fermentation and the development of grass and legume crop silage. Cassava peel, though, low in nitrogen, remains the most outstanding source of energy for ruminants [5]. The

peels contain toxic levels of cyanogenic glucosides, while the liquid contains a heavy load of microorganisms capable of hydrolyzing the glucosides. The resulting products of fermentation of cassava peels with squeezed out water can be processed and used as animal feeds [6]. Brewer's spent grains (BSG) are by-products of the brewing industry that is prepared mainly from fermented barley to produce beer. It has 230-290g/kg CP (dry matter basis) and is high in digestible fibre [7]. BSG is suitable for ruminants, particularly in dairy cows, to balance intake of large amounts of high starch diets, due to their fibrous nature and low energy content [8]. In many tropical countries whole, fresh banana leaves, stalks and pseudostems are chopped and fed either fresh, sun-dried or ensiled. Banana leaves contain about 15% DM and 10–17% CP [9]. Banana pseudostems (trunks) and leaves are useful sources of roughage in many tropical countries, mainly during the dry season. Poultry litter (PL) includes the beddings and other contamination in the poultry house and the poultry manure. Poultry litter is a good source of nitrogen, protein and ash [10]. Poultry litter and manure contain about 25% crude protein on a dry matter basis, about half of which derives from uric acid that can be efficiently used by rumen microbes for protein production, poultry litter is also rich in minerals. The results of many experiments in the world indicate that dried or ensiled poultry litter can be successfully included in the feed of ruminants as a protein supplement. The ensiling of the poultry litter is a simple and appropriate method of conservation. It has proved to be an excellent ingredient for cattle feeding, and the process significantly destroys harmful micro-organisms possibly present in poultry litter. Silage made from poultry litter, chopped root crops and bananas by-products provides a balanced diet for dairy cows. In order to increase farm incomes from livestock in developing countries, an adequate low-cost feeding system must be developed. Making silage from agricultural, agro-industrial by-products is a proven system, which offers considerable potential to improve farm incomes and profits.

Silage Production

Samples of fresh banana leaves (BL) were collected from the premises of Oyo State College of Agriculture and Technology, Igboora, cut into pieces and chopped using a chopping machine. Poultry waste (PW) used for the study was collected from birds reared at the Oyo state college of Agriculture and technology, Igboora, raised on deep litter for 8 weeks. The poultry waste was sun-dried for 3-5 days. The waste was bagged as Poultry Waste (PW). Cassava peels (CP) from 12-14 month old plants were collected fresh from the commercial "Garri" processing unit in Igboora neighborhood. The fresh cassava peels were used as Cassava Peel (CP). The banana leaves, poultry waste were mixed up with chopped cassava peel. The cassava peels were chopped using an improvised chopper to reduce the particle size to about 2-3cm to ease compaction. Brewers spent grain (BSG) was procured from Nigerian breweries Plc and transported to the site. Accurately weighed quantities of the ingredients were mixed properly packed into corresponding silos and well compacted manually. The silos were properly sealed with polythene sheets and sand bags were placed on top of the compacted mixtures to further minimize air entering. The silos were covered as fast as possible to disallow air from entering and being trapped in the ensiled mass. The silage was done in four treatments. control: 40% BL + 60% CP , Treatment 1: 40% BL + 20% CP + 40% BSG, Treatment 2: 40% BL + 20% CP + 40% PW and Treatment 3: 40% BL + 20% CP + 20% BSG+ 20% PW.

Experimental Animals and management

A total of sixteen white Fulani heifers were obtained from the teaching and research farm, Oyo State College of Agriculture and Technology, Igboora, Oyo State, Nigeria. The animal pen were thoroughly washed and cleaned few days prior the commencement of the experiment. The animals were given mineralized salt block and treated with Oxytetracylcine LA which was administered intramuscularly against pathogens or infections. Digestibility trial was for 14 days, out of which 7 days were for adjustment and 7 days for faecal collection and 90 days for the performance trial.

Experimental Treatments

Control: 40% BL + 60% CP
Treatment 1: 40% BL + 20% CP + 40% BSG
Treatment 2: 40% BL + 20% CP + 40% PW
Treatment 3: 40% BL + 20% CP + 20% BSG+ 20% PW

Key

BL: Banana leaves
CP: Cassava Peel
BSG: Brewers Spent grain
PW: Poultry Waste

Digestibility Trial

The animals were housed in their individual pens, the floor of the pen was made of concrete, constructed in a way that enhance easy packing of faeces. A measured quantity of experimental diets were offered to the animals for 7 days. Feed intake was measured by deducting feed refused from the feed offered, total faecal output for each experimental animal was weighed, recorded nd packed using hand trowel and put inside a plastic bucket for thorough mixing. After through mixing, little quantity of the faecal output were taken four (4) times within 7 days (at one day interval) from each experimental animal, weighed and oven dried at 65^0C to constant weight, milled and stored in air tight polythene bags. The milled oven dried samples were analysed using the general procedure of AOAC [11].

Performance studies

The animals were offered 10% their body weight of the experimental diets in their individual pen,

feed intake was obtained by deducting fed refusal from feed offered, weight gain was obtained by deducting final weight from initial weight, weekly weight gain was determined and recorded on weekly basis by using measuring tape placed round the animal heart girt just behind the front leg.

Also silage were taken on weekly basis weighed and oven dried in the lab at 65^0C to constant weight, milled and stored in air tight polythene bags. The milled oven dried samples were analysed using the general procedure of AOAC [11].

Chemical Analysis

Some samples of the feed and faeces were oven dried in the lab at 65^0C to constant weight and were analysed fir dry matter content, crude protein, ash and detergent fibre using the general procedure of AOAC [11].

Statistical Analysis

All data obtained were subjected to analysis of variance using SAS [12] procedure and means were separated using Duncan Multiple Range Tests (DMRT) of the same software.

RESULTS AND DISCUSSION

Result for chemical composition of silage fed to Zebu heifers during the experimental study show was that parameters across the treatments were significantly affected (P <0.05). S2 had the highest value for dry matter (51.22) and S0 had the lowest value (27.16). S1 had the highest value for crude protein (25.55), neutral detergent fibre (49.70), acid detergent fibre (30.60) and acid detergent lignin (14.50) while SO had the lowest value (1 1.19), (29.60), (22.10) and (11.30) respectively. Performance indices was presented in Table-1. Feed intake increased with an increase level of BSG 40%) in Silage 1, and a corresponding increase in weight gain and average daily gain. There was marked decrease in feed intake which had a negative effect on weight gain and average daily gain with increased level of PL (40%) in Silage 2, possible reason for this could be attributed to the fact that poultry Iitter is characterized by some offensive odour which reduces palatability as well as intake as reported by Caswell et al., 1975 [13]. Feed intake of the experimental animal increases with a reduced level of PL to 20% in Silage 3 when compared to 40% inclusion level in Silage 2, this had a positive effect on weight gain and average daily gain, possible reason could be attributed to [14] which reported that feed with strong (palatable) smell and taste may need to be added to mask unpalatable feed and BSG is known to be highly palatable feed stuff suitable for ruminant feeding.

Table-1: Shows the chemical composition of silage fed to Zebu heifers during the experimental study

Parameters	So	S1	Silage S2	S3
Dry matter (%)	27.16	27.99	51.22	35.21
Crude protein (%)	11.19	25.55	16.45	12.95
Neutral detergent fibre (%)	29.60	49.70	34.30	38.90
Acid detergent fibre (%)	22.10	30.60	25.30	26.20
Acid detergent lignin (%)	11.30	14.50	12.20	12.20

Means within the same row with different superscript differ (p<0.05)

Table-2: Shows performance indices of Zebu heifers fed banana stem and leaf ensiled with cassava peel, brewers spent grains and poultry waste

Parameter	S0	S1	S2	S3
Feed intake (kg/d)	8.92	19.57	5.88	14.33
Weight gain (kg/wk)	4.52	17.02	-6.23	-1.23
Average gain (kg/d)	0.22	0.81	-0.30	-0.06

Means within the same row with different superscript differ (p<0.05)

Mean dry matter digestibility of Silage fed to Zebu heifers during the study shows that all parameters across dietary treatments were significantly affected (P <0.05). SI had the highest level of dry matter intake (526.91) and dry matter digestibility (67.05), while SO had the lowest levels of Dry matter intake (233.44) and faecal output (96.86). S3 had the highest value of faecal output (205.17). The chemical composition of facces voided by Zebu heifers during digestibility trial shows that neutral detergent fibre were significantly affected (P <0.05) while acid detergent fibre and acid detergent lignin were not significantly affected (P> 0.05). SO had the highest value of neutral detergent fibre (6l.88) and S2 had the lowest value of (52.64), S2 had the highest values of acid detergent fibre (58.90) and acid detergent lignin (19.00), while the lowest value of acid detergent fibre (37.33) was seen in S2.

The CP (crude protein) levels recorded in the study (11.19-25.55%) were higher than the 2-5Y% reported by Ben Salem et al., [15]. Also higher than the range of 8.9-16% reported by NRC 1981 [16] for maintenance and moderate growth in ruminants. This could be attributed to inclusion of BSG having CP of

about 28% as reported by [17] or PL with CP of about 26% [18] which makes it a good protein supplement in livestock feeding and protein is needed for growth and development of animal tissue. Similarly, protein and energy consumption are interlinked. When protein content of diets is inadequate, intake drops and digestibility of energy is reduced. It was found out that the intake of sheep decreased when the crude protein content of their diet fell to 7% [19]. Intake of the experimental animal is maintained at high level without creating health problem, this indicates finer chopping of crop residues e.g (BSL). (CSP) and proper processing of animal waste (PW), agro industrial by products (BSG) which result in improved compaction and fermentation of silage and also improves palatability and intake of the silage, also the animals had a positive increase in growth rate and no any form of infection from feed as poultry litter are known as ideal medium for the development of fungi [20].

Table 3: Shows the Mean Dry Matter Digestibility of Silage fed to Zebu Heifers during Digestibility

Parameter	S0	S1	S2	S3	SEM
Dry matter intake (g/d)	233.44	526.91	258.10	485.90	-
Faecal output (g/d)	96.86	172.88	117.56	205.17	-
Dry matter Digestibility (%)	62.91	67.05	54.76	58.33	2.55

Means within the same row with different superscript differ ($p<0.05$)

Cattle fed Silage 1 (:40% banana stem and leaf+ 20% cassava peel + 40% brewers spent grain), recorded the highest values for crude protein and dry matter digestibility which is essential for growth and energy respectively as shown on Table 4 and 5. These results showed marked improvement in the digestibility of nutrient by animals on silage 1. Thus 40% inclusion level of in the silage, reflects efficient utilization of nutrient in the silage and hence recording the highest daily weight gain as shown on (Table-7).

However, values for Dry matter digestibility are shown on Table-5. These digestibility coefficients ranged from 54.76%-67.05% and were not comparable to 78-80% DM digestibility coefficients observed by Hadjipanayiotou [21] for ruminants fed hay supplements with concentrates, this does not means the silage is not well digested by the experimental animals. Possible reason for low dry matter digestibility could be attributed to [22] who reported that delaying harvest of materials reduced silage feed value (as indicated by digestibility). ADF content ranged from 37.33 to 38.90% and this was higher than the minimum range of 19 to 21% recommendation as ideal in ruminant diets [23]. The digestibility of NDF, ADF and ADL of the silage was higher than minimum requirement, indicating that the level of protein in the silage was nutritionally adequate to facilitate the effective digestion of the fibre fractions by rumen microbes.

Table-4: Shows the chemical composition of faeces by Zebu heifers during digestibility trial

Parameter	S0	S1	S2	S3
Neutral detergent fibre (%)	61.88	58.83	52.64	54.28
Acid detergent fibre (%)	37.98	38.15	38.90	37.33
Acid detergent lignin (%)	18.43	18.38	19.00	18.40

Means within the same row with different superscript differ ($p<0.05$)

CONCLUSION

In order to increase farm income from livestock in developing countries, an adequate low-cost feeding system must be developed. Making silage from agricultural, agro-industrial and animal waste is a proven system offering considerable potential to improve animal performance and digestibility, farm incomes and profits. Agriculture Ministries should survey the types, qualities, quantities and seasonal availability of by-products available in their country. The current levels of utilization should also be assessed. From the results of this study, Practical programmes of further research and extension can be in each country. These should create and demonstrate a range of model feeding Systems based on ensiled by-products in addition to other available feeds. Such feeding systems would have formulations based on local or national by-product availability, feeding requirements and critical annual periods of feed shortage.

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