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Research Paper

Effect of Moisture Level on the Nutritive Value of Sugarcane Waste (*Sacchrum offisinarum*) enhanced with Poultry Litter

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Abstract

This study evaluated the effect of moisture levels on the nutritive value of sugarcane waste (*Saccharum officinarum*) enhanced with poultry litter through ensiling. Sugarcane waste was collected from processing points, sun-dried for 7 days, and milled through 8mm mesh. Poultry litter obtained from deep litter production system was similarly processed. The milled sugarcane waste and poultry litter were mixed in a 60:40 ratio and ensiled with four different moisture treatments: A (600ml water/25kg), B (800ml/25kg), C (1000ml/25kg), and D (1200ml/25kg). The mixtures were compacted into laboratory silos, sealed, and fermented for 21 days in a completely randomized design with three replications. Physical properties (color, aroma, texture, mould presence) were evaluated subjectively, while proximate composition (dry matter, crude protein, crude fiber, ash, ether extract, and nitrogen-free extract) was determined following AOAC (2005) procedures. Results showed that treatment C exhibited the highest crude protein content (13.67%) and ash (5.70%), while treatment A had the highest crude fiber (6.87%). Treatment B showed the highest ether extract (4.43%), and treatment D had the highest nitrogen-free extract (78.96%). Physical evaluation revealed that treatments A, B, and D produced firm silage without mould, whereas treatment C showed slimy texture with mould formation. Moisture and dry matter values showed no significant differences across treatments (P>0.05). The study concludes that moisture variation significantly influenced the proximate composition of ensiled sugarcane waste-poultry litter mixtures, with treatment C providing superior crude protein content. However, physical quality concerns with treatment C suggest the need for further optimization.

1. Introduction

The provision of good quality all year round forage or feed is a major problem in ruminant production system in Nigeria. Forage availability is usually inadequate and the quality of the available ones is poor in the tropics for feeding most of the year. Ruminant production in dry season could be improved upon by cultivating plants during the cropping season and their waste removed during harvesting, dried and stored as fodder for ruminants feeding during the scarce period when most of these animals lose a percentage of their body weight as a result of shortage and poor quality forage(Lakpini, 2002).

The feed resources available to small holder farmers in the tropics are mainly range forages, crop residues or wastes and agro industrial by-products. These wastes which form bulk of the feed resources are generally low in protein and high in cellulose contents. Sugarcane waste among other crop residues have been reported to be abundant and left unutilized when primary crop or product have been obtained. These when properly processed and utilized can make the waste a cheap source of nutrients especially dietary energy and fermentable products for small holder ruminant production (Mickan, 2005).

Various physical, chemical and biological treatments have been used to improve the utilization of low quality feed such as corn cob and sugarcane waste (Abasiekong, 1991). The most popular is chemical treatment through the use sodium hydroxide, an alkali which apart from its unavailability could be hazardous owing to its caustic nature (Adebowale, 1995). The use of urea solution for treatment in some parts of the world might be more practical but it is also expensive to the rural farmers. Meanwhile, researches into the use of by-products like poultry litter at various level of dietary inclusion have been shown to improve digestibility of poor quality feed (Adebowale, 1995).

There is much availability of sugarcane waste in Northern Nigeria. Sugarcane waste pollutes the environment and if burnt causes air pollution which might increase global warming. Utilization of sugarcane waste is very important in feeding animals like ca and cattle, sheep and goats. In Nigeria sugarcane waste can provide cheap source of feeding stuff with appreciable amount of nutrient (Ayoadeet al., 2007) therefore, could be used to feed livestock. The treatment will increase the nitrogen content of the diet and also improves digestibility and utilization of

fiber by the animals.

The shortage of feed in terms of quality and quantity, especially during the dry season is one of the most serious problems faced by farmers. One of the major problems of feeding ruminants in Nigeria is the seasonal variability and nutritional values of native pasture (Obua, 2005). In (Ekop, 1998). Northern Nigeria where the production of sugarcane is high, a huge amount of sugarcane waste is generated. Sugarcane waste comprises of the tops, peels, bagasse and the roots. However, the use of sugarcane waste as ruminant feed is limited due to its low content of nutrients. Possible intervention that will lead to improvement in nutrient contents of fibrous feedstuffs have been reported (Akinfemiet al., 2010).

Silage catastrophes are usually due to ensiling crops with less than ideal ensiling management practices. This includes situations where crops are ensiled with improper moisture, maturity, packing, sealing and feed out management. However, if ensiled under Incorrect conditions of moisture, different and poorer fermentation can occur, resulting in unpalatable and lower quality silages The study is aimed to assess the effect of moisture at different levels of fermentation of sugarcane waste enhanced with poultry litter which is available and less expensive for effective utilization by ruminant animals.

2. Materials and Methods

2.1 Study Area

The study was conducted at the Animal Science Laboratory, Kano University of Science and Technology, Wudil Kano State, located at longitude 8°25'E and latitude 12°58 N. The area has an average annual rainfall of 890mm with an average temperature of 26°C (Olofinet al., 2008).

2.2 *Collection and Preparation of Experimental Materials*

Sugarcane waste was collected from processing/selling points identified within and around the University Campus. All foreign materials (stones, iron and polyethene) were removed. Poultry litter was obtained from a deep litter production system. The collected sugarcane waste and poultry litter weresun dried for 7-9 hours depending on the weather for 7 days until they become dry. The dried sugarcane waste and poultry litter were then milled separately through 8mm mash in a hammer mill.

2.3 Ensiling Procedure

The milled sugarcane waste was then mixed with the poultry litter in theratio of 60:40. Water (moisture) was used in four (4) different proportions of 15, 20, 25 and 30 liters for every 25kg of the mixed poultry litter and sugarcane waste. The material was filled and compacted into the laboratory silos (experimental bottles) and covered as fast as possible to disallow air from being trapped in the silage. Masking tape was used to further seal the bottles after filling with weighed materials and compressed. The samples were ensiled for 21 days in triplicate. At the expiration of the ensiling period, the laboratory silos were opened and the top most 5cm material was scooped off to avoid contamination with partially ensiled materials. The samples were taken using forceps from each laboratory silo for physical observation and the contents were scored for aroma and color by three independent scorers on a subjective score of 1-4 of (Table 1). Furthermore, sub samples were taken from all the silages and oven dried at 60°c for 48 hours for chemical analysis.

2.4 *Experimental Design*

The design of the trial was completely randomized design (CRD) as outlined by Steel and Torrie (1980) which consists of four (4) experimental treatments replicated three times. Thus, a total of twelve (12) samples were used for the experiment.

2.5 Analytical Techniques

Thoroughly mixed representative samples of the silage treatments (A-D) were analyzed for proximate compositions (DM, CP, CF, Ash, EE and NFE) according to AOAC (2005) procedures.

2.6 Statistical Analysis

Data obtained from this experiment was analyzed using the General Linear Model (GLM) of statistical package (SAS, 2002).

3. Results

3.1 Physical Properties of the Ensiled Materials

The results obtained for color, aroma and texture of the ensiled material were presented on table 2 From the results obtained treatment A and C had score of 1 for color and aroma (Dark or deep with or rancid aroma), however treatment B had score 2 for color (light brown) and 3 for aroma (sweet aroma). Treatment Don the other hand scored 3 for color (pale yellow) and 2 for aroma (pleasant sweet). All the treatment is firm in texture with exception of treatment C which is slimy. Treatment A, B and D does not have mould, however treatment C have moulds appearing at the top most of the ensiled material.

Table 1: Description of Color and Aroma Ratio used as indices of Silage Quality

Rating	Color	Aroma
1	Dark or deep brown	Putrid or rancid
2	Light brown	Pleasant
3	Pale yellow sweet	
4	Yellowish green	Very sweet

3.2 Proximate Composition of the Ensiled Materials

Table 2: Physical properties of the prepared silage

Treatment	Color	Aroma	Texture	Other observations
A	1	1	firm	-
B	2	2	firm	-
C	1	1	slimy	Mould on top
D	3	3	firm	-

A (60% SCW + 40% PL: 600mls of water), B (60%/ SCW + 40% PL: 800mls of water), C (60%SCW + 40% PL: 1000mls of water), D (60% SCW + 40% PL: 1200mls of water)

The proximate composition of the ensiled sugarcane waste enhanced with poultry litter was shown on Table 3. The values for moisture ranged between 13.80% in treatment D to 14.30% in treatment C while that of DM ranged between 85.70% in treatment C to 86.55% in treatment B. Mean CF was significantly ($P<0.05$) higher in treatment A (6.87%) while treatment B had the least mean value of CF (4.83%). The CP content of the ensiled material was found to be significantly ($P<0.05$) different in treatment C (13.67%) whereas treatment B had the lowest value (8.02%). Ash content was found to be significantly ($P<0.05$) higher in treatment C (5.70%) with treatment D having the lowest value (3.52%). Treatment B (4.43%) have the highest significant ($P<0.05$) value for EE mean values and treatment D (2.72%) have the lowest value. The mean NFE value was significantly ($P<0.05$) higher in treatment D (78.96%) with treatment C (72.51%) having the lowest value.

4. Discussion

4.1 Physical Properties of the prepared silage

Ensiling process is known to be use in processing and enhancing palatability of certain feed ingredients (UNPAC, 1989). Oduguwaet al. (2007) stated that the most important physical characteristics in terms of acceptability of silage to animal are odour, but other physical properties helped to determine well preserved silage. Silage quality can be evaluated physically as smell, texture and color (Wattiaux, 2000). The colors obtained in the present study were close to the original color of the material used in the silages. This observation coincides with the findings of (Oduguwaet al., 2007). All the compounded silages were firm in texture without mould which is an indication of good silage, however treatment C was found to be slimy in texture indicating spoilage and mould growth (Kung and Shaver, 2002).

Table 3: Proximate composition (%) of the Ensiled Materials

4.2 Proximate Composition of the prepared silage

There was no significant difference in both moisture and DM values indicating that the varying moisture levels have no effect on the ensiled SCW and PL, however the mean DM values were found to be lower than the value of 90% DM reported by Boda (1990). The CP value range from 13.67 to 8.02% which was within the range of 8 to 16% as reported by Maigandi (2009). Mean CF value ranges from 6.87-4.68% which was below the range of 25.1239.44% obtained by Ajayietet al. (2011). Ash content of the ensiled samples were much higher than the 1% ash reported by Boda (1990), and much lower than the value 10.08 to 12.67% reported by Maigandiet al. (2002). This is probably due to differences the ensiling materials used.

5. Conclusion

The study concludes that ensiling of sugarcane waste with poultry litter has a significance effects in improving the physical properties and proximate composition of the SCW. Furthermore, the result shows that moisture content of the silage was not significantly affected even though moisture was varied. The study recommended that ensiling of sugarcane waste with poultry litter should be done using moisture greater than the used one since the moisture content of the ensiled sugarcane waste was not significantly affected even though moisture was varied. However, treatment C (60% SCW + 40% PL: 1000mls of water) is having higher CP content and can therefore be used for ruminant feeding among other treatment.

6. Statements and Declarations

Ethical Approval: Not applicable

Conflict of Interest: The authors declare that they have no known competing financial interests, personal relationships, or conflicts of interest that could have influenced the work reported in this study.

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	Treatments				
Parameters	**A**	**B**	**C**	**D**	**LSD**
Moisture	13.82	13.45	14.30	13.80	2.158
DM	86.18	86.55	85.70	86.20	2.158
CF	6.87[a]	4.83[b]	4.68[b]	5.40[b]	0.875
CP	12.58[b]	8.02[d]	13.67[a]	9.41[c]	1.009
Ash	4.73[b]	3.77[c]	5.70[a]	3.52[c]	0.521
EE	3.73[b]	4.43[a]	3.43[b]	2.72[c]	0.521
NFE	72.09[b]	78.94[a]	72.51[b]	78.96[a]	1.350

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