

EFFECT OF FEEDING ENSILED SUGARCANE WASTE ON RUMEN FLUID CHARACTERISTICS OF YANKASA RAMS

^{*}Dan Abba, Y. U., [#]Ashiru, R. M., ⁺Ubayi, K. M & ^{\$}Ibrahim, J

^{*}Department of Animal Science, Federal University Dutsin-ma, Katsina, Nigeria

[#]Department of Animal Science, Kano University of Science and Technology, Wudil, Nigeria

⁺Bilyaminu Usman Polytechnic, Hadejia, Jigawa State Nigeria

^{\$}Umar Suleiman College of Education, Gashuwa, Yobe State, Nigeria

(*yusufdanabba07@gmail.com)

ABSTRACT

A feeding trial was conducted to assess the effect of inclusion of ensiled sugarcane waste (ESCW) with poultry litter on rumen fluid characteristics of Yankasa rams in a completely randomized design (CRD) for twelve weeks (84 days). Sugarcane waste was mixed with poultry litter in 3:1 and ensiled for 21 days. The ESCW was used as partial replacement in complete diet. Sixteen Yankasa rams (mean body weight 21.87±2kg and aged 12 to 18 month) were allotted to the four groups on the of body weights into control without ESCW (CG) or control diets partially replaced with ESCW 15% (T1), 30% (T2) or 45% (T3) as treatment groups (TG). Diets were offered *ad-libitum*, along with clean drinking water and mineral salt lick at will. Ten (10mls) of rumen liquor was drawn individually from all experimental animals using rubber stomach tube before feeding (0 hours), at 3 hours and 6 hours after morning feeding for pH and microbial counts determination. The results showed that there were significant ($P<0.05$) differences in bacteria counts at 3 and 6 hours sampling periods while fungi counts were significant ($P<0.05$) different at 0 and 3 hours sampling periods. In conclusion, feeding of ESCW maintained the pH of the rumen fluid at optimum for fibre digestion. The results further indicated that the number of bacteria and fungi in solution were adequate for fibre degradation. Therefore, inclusion of up to 45% ESCW could be done to improve its utilization by Yankasa rams.

Key words: Ensilage rumen pH bacteria fungi

INTRODUCTION

The major constraint to livestock production in developing countries is the scarcity and fluctuation in quantity and quality of year round forage supply. During the dry season, the available forages are very low in protein, energy and minerals leading to a marked decrease in the voluntary feed intake and digestibility (Akinwande *et al.*, 2011). With increasing demand for livestock products as a result of rapid growth in the world economic and shrinking land area, future hope of feeding the ever increasing population will depend on the better utilization of non-conventional feed resources. Any factor affecting rumen microorganism populations directly or indirectly affects yield and feed efficiency ratio (Hobson and Stewart, 1997). Sugarcane (*Saccharum officinarum*) is a typical or sub-tropical perennial grass. Sugarcane waste is obtained when the cane is being processed for chewing (Ashiru *et al.*, 2016), it comprises of the top, peels, and bagasse. Sugarcane waste has not gain much attention in ruminant feeding, it is dumped on the street and water ways which often constitute nuisance in the environment by blocking drainage. Although a number of non-conventional feeds are traditionally used in livestock feeding little or no information is known on their effects on the rumen environment.

OBJECTIVES

This study therefore aims at evaluating the effect of ensiled sugarcane waste on rumen fluid characteristics of yankasa rams.

MATERIALS AND METHODS

The study was conducted at the Research Farm, Department of Animal Science, Kano University of Science and Technology, Wudil, Kano State, located in the Sudan Savannah Region of Nigeria. The site is situated between longitude 8°25'E and latitude 12°58'N. The area has an average annual rainfall of 890mm with a peak in August with an average annual temperature of 38 to 43°C and relative humidity of 40 to 51% (Olofin *et al.*, 2008). There are three distinct seasons recognized in the area viz: dry cold (October to January), dry hot (February to May) and wet (June to September).

ENSILING PROCEDURE AND EXPERIMENTAL MATERIALS

Sugarcane waste (SCW) was collected within and around Kano State, cleaned for extraneous materials like stones, iron and polyethene. Poultry litter (PL) was obtained from a deep litter poultry production system. The collected SCW and PL were sun dried for a period of 3 days during dry season by thinly spreading on a concrete floor. The dried SCW used for the silage were chopped into about 2-3cm length using forage chopper for better compaction (Ogunlolu *et al.*, 2010). SCW was ensiled with PL (ESCW) in the ratio 75: 25, for 21 days after wetting with water at the rate of 15 l/25kg mix in a 300 liter capacity plastic water reservoir as silo. Silo filled with weighed materials was covered with polyethene and compressed by human trampling. Five hundred kilograms (500kg) of the ESCW with PL was produced and used to formulate four diets (Table 1). Other concentrate feed ingredients included in the diets were maize, wheat offal, full fat soybean meal, cowpea husk and salt. The diets were fed *ad-libitum* as complete diet to all the experimental rams.

EXPERIMENTAL ANIMALS AND MANAGEMENT

Sixteen male Yankasa rams (Mean body weight 21.87 ± 2 kg; aged 12 to 18 months) were purchased from the market and quarantined for two weeks. The rams were treated for internal and external parasites with Ivomec[®] – super at 200µg/kg body weight subcutaneously before the start of the experiment. Rams were divided into 4 groups of 4 animals each in CRD based on live weight (Steel and Torrie, 1980). Control group (CG) was fed diet without ESCW while other 3 treatment groups (TGs) were fed 15, 30, and 45% of ESCW, respectively replacing the concentrate feedstuffs (Table 1). Rams were housed in individual pens measuring 2m x 1m. The pens were cleaned and disinfected using Omo[®] detergent and Moriguard[®]. Water and salt lick were provided *ad libitum*.

DATA COLLECTION

Ten (10mls) of rumen liquor was drawn individually from the all experimental animals using rubber stomach tube before feeding (0 hours), at 3 hours and 6 hours after morning feeding. The collected samples were strained through two layers of cheese cloth (Prigge *et al.*, 1984), the pH was measured immediately using a digital pH meter. Strained rumen fluids were stored in glass bottles and immediately transferred to laboratory for analysis.

CHEMICAL ANALYSIS

Thoroughly mixed representative samples of the experimental diets and faeces were analyzed for dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE), ash and nitrogen free extract (NFE) according to AOAC (2005) procedures. The bacteria, protozoa and fungi, in the rumen fluid were estimated at 0, 3, and 6 hours after morning feeding by the method described by Broudiscou *et al.* (1997).

STATISTICAL ANALYSIS

Data were subjected to analysis of variance (ANOVA) using CRD and significant differences between the means were tested by least significant difference (Steel and Torrie, 1980). Differences between the means were considered significant at 5% probability level ($P < 0.05$). The data were analyzed using SAS Statistical package (SAS, 1989). The tools of the study were generally linear model (GLM) package of SAS. Where means was separated using the least significant difference (LSD).

RESULTS AND DISCUSSION

Chemical composition (%) of the experimental diets

The results of the chemical composition of experimental diets are presented in Table 2. It can be seen that dry matter varied from 90.78% in CG to 94.80% in TG3. Percent DM values obtained in the present study were comparable and differed slightly from the DM values 94.00 to 95.00% reported by Sirajo *et al.* (2010) for diets containing graded levels of PL waste. Crude protein content of the TGs varied from 14.39 to 14.87% while that of CG was 13.89%. The CP values obtained in the present study were higher than the range of 10 to 12% recommended by Gatenby (2002).

RUMEN FLUID CHARACTERISTICS

The results for rumen fluid characteristic of Yankasa rams fed graded levels of ESCW ensiled with PL are shown in Table 3. There were significant ($P < 0.05$) differences among different means of diets at different sampling times for pH, bacteria and fungi, except for 0 hours (before feeding). There were no significant ($P > 0.05$) differences in pH values at all the sampling periods. Rumen pH is an important factor affecting fermentation in the rumen and influences its function. The CG and the TGs had neutral pH values at 0 hours, the pH tended to be more acidic after 3 hours post feeding, but showed less neutral pH at 6 hours of post feeding. According to Campbell *et al.* (1988), changes in pH could be due to plane of feeding. Intake of feed has a major effect on rumen pH which generally declines after feeding (Maekawa *et al.*, 2002a). At 3 hours post feeding bacteria counts in TG2 were significantly ($P > 0.05$) higher than those of CG, while at 6 hours, bacteria the CG had significantly ($P < 0.05$) higher bacterial counts. Bacterial count was observed to be the same statistically at 0 hours sampling time for all the treatments, this might be due to the starvation since all animals were not given any feed. The observed increased in bacterial count at 3 hours might be due to bacterial activities in the rumen after feeding which resulted in the conversion of feeds to VFAS. The decrease in bacterial count at 6 hours sampling time might be due to the fact that microorganisms themselves are digested to free up nutrient for the ruminants use (Ensminger, 2002). Similarly fungi counts were significantly ($P < 0.05$) different at 0 and 3 hours sampling. At 0 hours, the CG had significantly ($P < 0.05$) higher fungal counts while at 3 hours sampling period the CG is comparable to TG3. Fungi appears to be the first organisms to invade and commence digesting the structural plant components, beginning from the inside, they reduce the tensile strength of these particles (Akin *et al.*, 1989) and thus increase particle breakdown in rumination. This might be attributable to the fungi's efficient enzymes system which can degrade structural elements of the plant cell wall.

CONCLUSION AND RECOMMENDATION

In conclusion, feeding of ESCW maintained the pH of the rumen fluid at optimum for fibre digestion. The results further indicated that the number of bacteria and fungi in solution were adequate for fibre degradation. Therefore, inclusion of up to 45% ESCW could be done to improve its utilization by Yankasa rams.

REFERENCES

- Akin, D. E. (1989). Histological and physical factors affecting digestibility of forages. *Agronomy Journal* **81**: 17 -25.
- Akinwande, V. O., Mako, A. A. and Babayemi, O. J. (2011). Silage quality, voluntary feed intake (VFI), nutrient digestibility and nitrogen balance in West African Dwarf sheep fed ensiled Water Hyacinth (WH) in Nigeria. In: A. A. Adeniji, E. A. Olatunji and E. S. Gana (eds.) *Value Re – Orientation in Animal Production: A Key to National Food Security and Stable Economy*. Proceedings of the 36th Annual Conference of the Nigerian Society for Animal Production (NSAP), 13th – 16th March, held at Merit House/Raw Materials Research and Development Council, Abuja. Pp 509 – 512.
- AOAC (2005). **Association of Official Analytical Chemists. Official Methods of Analysis** 18th Edition AOAC Inc, Arlington, Virginia USA. 1094pp.
- Ashiru, R. M., S. A. Maigandi, I. R. Muhammad, Muktar, I. S. (2016). Chemical Properties of Ensiled Sugarcane Waste Treated With Non-Protein Nitrogen Sources and Soybean Residue. *Techno Science Africana Journal* 13 (2), 224 - 231. ISSN 2006-2273
- Broudiscou, L. P., Papon, Y., Fabre, M. and Broudiscou, A. F. (1997). Maintenance of rumen protozoa populations in a dual outflow continuous fermenter. *Journal of Science Food and Agriculture*, **75**: 273-280.
- Ensminger, M. E. (2002). **Sheep and goat science**. 6th ed. Danville, IL: Interstate Publisher, Inc.

- Hobson, P. N. and Stewart, S. S. (1997). **The Rumen Microbial Ecosystem**, 2nd Edition. New York: Springer.
- Maekawa, M., Beauchemin, K. A. and Christensen, D. A. (2002a). Effect of concentrate level and feeding management on chewing activities, saliva production, and ruminal pH of lactating dairy cows. *Journal of Dairy Science* **85**: 1165-1175.
- Ogunlolu, B. T., Jolaosho, A. O., Akinola, T. O. and Aniwe, P. O. (2010). Effects of length of storage and mixture of cassava peel, pineapple residues and guinea grass on mineral content of silage. In: O. J. Babayemi, O. A. Abu and E. O. Ewuola (eds.) *Fast – Tracking Animal Agriculture in a Challenged Economy*. Proceedings of the 35th Annual Conference of the Nigerian Society for Animal Production (NSAP) 14th - 17th March, held at University Ibadan, Nigeria. Pp 489-490.
- Olofin, E. A. (1985). Human responses to the Natural environments in Kano Region In: Barkindo, A. A. (ed.) **Kano and its Neighbours**. Ahmadu Bello University Press, Zaria.
- Prigge, E. C., Baker, M. J. and Varga, G. A. (1984). Comparative Digestion, Rumen Fermentation and Kinetics of Forage Diets by Steers and Wethers. *Journal of Animal Science*, **59**:237-245.
- SAS. (1989). Statistical Analysis System SAS/STAT. Guided for Personal Computers. Version 6 Edition, Cary N.C. USA 967 – 978pp.
- Sirajo, A., Maigandi S. A., Malami, B. S. and Daneji, A. I. (2010). Nutritional evaluation of poultry litter waste fed to growing Uda sheep. In: O. J. Ifut, U. A. Inyang, I. P. Akpan and I. E. Ebeso (eds.) *Diversifying Nigeria's Economy: Animal Production Option*. Proceedings of the 15th Annual Conference of the Animal Science Association of Nigeria (ASAN), 13th – 16th September held at University of Uyo, Akwa Ibom State, Nigeria. Pp 592 – 593.
- Steel, R. G. D. and Torrie, J. H. (1980). **Principles and Procedures of Statistics**. A Biometrical Approach, 2nd Edition. McGraw – Hill, New York.

Table 1: Composition (%) of Complete Experimental Diets Fed to Yankasa Rams

Ingredients	CG (0%)	Treatment Groups (TGs)		
		TG1 (15%)	TG2 (30%)	TG3 (45%)
Ensiled SCW with PL (3:1)	0	15	30	45
Groundnut haulms	20	15	15	10
Wheat bran	20	20	15	15
Cowpea husk	20	20	15	15
Maize	19	14	9	9
Soybean meal	5	5	5	5
Rice milling waste	15	10	10	0
Salt	1	1	1	1
Total	100	100	100	100
CP (%)	13.66	13.64	13.51	13.74

Table 2: Chemical composition (%) of experimental diets

Parameters	CG (0%)	Treatment Groups (TGs)		
		TG1 (15%)	TG2 (30%)	TG3 (45%)
DM	90.78	92.21	94.80	93.33
CP	13.89	14.87	14.39	14.50
CF	26.09	25.29	22.88	20.60
EE	4.05	3.98	3.71	3.27
Ash	11.68	11.08	8.13	8.19
NFE	43.31	45.35	51.39	53.44

Table 3: Rumen fluid characteristics of Yankasa rams fed ESCW

Parameters	Sampling Time (hrs)	Treatment Groups (TGs)				LSD
		CG (0%)	TG1 (15%)	TG2 (30%)	TG3 (45%)	
pH	0	7.46	7.61	7.71	7.67	0.908
	3	5.53	5.58	5.63	5.90	0.783
	6	6.95	6.55	6.52	6.94	0.886
Bacteria $\times 10^6$ cfu/ml	0	7.30	7.28	7.60	7.32	1.001
	3	8.17 ^b	8.80 ^{ab}	8.97 ^a	8.87 ^{ab}	0.724
	6	7.24 ^a	6.73 ^{ab}	6.35 ^{bc}	5.98 ^c	0.654
Fungi $\times 10^6$ cfu/ml	0	6.88 ^b	6.67 ^b	8.85 ^a	6.68 ^b	1.106
	3	7.38 ^a	6.31 ^b	6.20 ^b	7.25 ^a	0.850
	6	6.71	6.68	6.73	6.83	1.128