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Performance characteristics and nitrogen metabolism of West African dwarf rams fed diets containing varying levels of sugarcane waste silage

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Target Audience: Ruminant livestock Farmers, Crop farmers, Nutritionist and Researchers.

Abstract

Sugarcane waste are usually generated in large quantity, dumped and therefore causing environmental pollution. Hence a forteen week study was conducted to investigate the growth performance and nitrogen utilization of West African Dwarf (WAD) rams fed diets containing varying levels of sugarcane waste silages (SWS) 0, 50, 75 and 100% inclusion levels as replacement for cassava peels. A total of sixteen (16) WAD rams were allotted into four dietary treatments in a completely randomised design. Data were collected on growth performance and nitrogen utilization. Results obtained showed that the experimental diets did not significantly ($p > 0.05$) influenced the growth performance except the final weight and feed conversion ratio. Ram on T_2 recorded the highest final weight value (16.52 kg) and best feed conversion ratios value (18.03) when compared with other dietary treatments. No significant ($p>0.05$) differences among the dietary treatments were observed in all the nitrogen utilization parameters observed except the total nitrogen loss and nitrogen utilization. The nitrogen utilization values varied significantly ($P<0.05$) across the dietary treatments in which rams fed silages containing 50% sugarcane waste had the highest value (63.29%). It can therefore be concluded that rams fed 50% inclusion level of sugarcane waste exhibited the best growth performance and positive nitrogen utilization.

Keywords: Growth, Sugarcane, Nitrogen retention, rams.

Description of Problem

Nutrition has been identified as one of the major factors responsible for poor performance of the indigenous breeds (1). The animals are exposed to severe nutritional stress especially during the dry season when forages are scarce and of low quality (2). This leads to weight loss, mortality, decreased reproductive performance and lamb mortality. The productivity of these breeds can be improved and hence increase the animal protein intake of average Nigerian by utilizing non-conventional feedstuffs agro-industrial products such as cassava peel, maize cob, wheat offal and sugarcane waste which were regarded as waste. Sugarcane wastes are usually generated in large quantity underutilized dumped indiscriminately and causes environmental pollution. It contains higher amounts of sugar-rich juice and is more valuable for ruminants (3). Utilization of these wastes will reduce stiff competition between man and animals for conventional feedstuffs. During the period of short feed supply with pasture due to high cost and seasonality, ruminant livestock farmers have been stimulated to search for alternative

feed resources that can economically supplement the feed ingredients in ratio without adverse effect on the rumen microbial fermentation and performance of the animals (4).Water soluble carbohydrates available in sugarcane are fermented into lactic acids during ensiling which decreases p^H, inhibits the activity of plant enzymes and reduces pathogenic or spoilage bacteria that can reduce the nutritive value of the silage thereby preserving carbohydrates and proteins (5). Therefore this study was aimed at evaluating the growth performance and nitrogen utilization of West African Dwarf rams fed diets containing varying levels of sugarcane waste as a replacement for cassava peels.

Materials and Method

Experimental Site:

The experiment was carried out at the small ruminant unit of Institute of Agricultural Research and Training (IAR&T) Moor Plantation, Ibadan in the South Western part of Nigeria. The area lies within longitude and latitude 7.27^0E and 3.25^0N respectively. The mean annual temperature and humidity of the area are about 30 - 35^0C and 76-84% respectively.

Experimental Diets:

The sugarcane wastes including the tops and peels were collected from Papa Lanto, Ewekoro Area of Ifo Local Government Ogun State. It was chopped into smaller units and later incorporated into experimental diets containing other agro-industrial by products at varying levels of 0, 50, 75 and 100% respectively to formulate four dietary treatments such that fresh cassava peel was replaced with it. These were then ensiled for 28 days under anaerobic condition in a 50kg plastic silo to make silage.

Table 1: Gross composition of Experimental s diet (g/100g) containing varying levels of sugarcane waste silage

Ingredients (%)	T1 (0%)	T2 (50%)	T3 (75%)	T4 (100%)
Fresh cassava peel	45.00	30.00	15.00	0.00
Sugar cane waste	0.00	15.00	30.00	45.00
Groundnut Haulms	13.00	13.00	13.00	13.00
Cowpea Husk	10.00	10.00	10.00	10.00
Palm Kernel cake	20.00	20.00	20.00	20.00
Dried Brewer Grain	9.50	9.50	9.50	9.50
Di Calcium Phosphate	2.00	2.00	2.00	2.00
Premix	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00

Experimental Animals, Feeding and Management

A total of sixteen (16) West African Dwarf rams were purchased for this study. Prior to arrival of the animals, the experimental pens were properly washed and disinfected. At the commencement of the experiment, rams were housed individually in each pen, oxytetracycline L/A and multivitamin was administered to ensure good body condition of the animals. They were also routinely dewormed with Albendazole and ivermectin was injected to eliminate both endo and ecto parasites respectively. The animals were also vaccinated against PPR infection (*Pestis des petit ruminant)*. The animals were acclimatized for a period of one month during which they were fed and maintained on cassava peel. Diets were served twice daily at about 8.00am in the morning and 4.00pm in

the evening at 5% of the body weight. Cool clean fresh water was served *ad-libitum* throughout the experiment. After the adaptation period, the sixteen West African Dwarf rams were balanced as closely as possible by their body weight and allotted into four (4) dietary treatments consisting of 4 rams per treatment. The study lasted for 14 weeks after 7days of adjustment period. The animals were randomly allotted to the four experimental diets with four rams per replicate in a completely randomized design.

Data Collection

Growth Performance

The West African Dwarf rams were weighed individually at the start of the experiment. Weekly body weight change was determined before feeding in the morning throughout the experimental period. Daily Feed Intake was measured by subtracting the leftover from the total feed given to the rams per head per day. The feed conversion ratio was obtained by dividing the feed intake of the animals by the weight gain.

Nitrogen Utilization

Nitrogen utilization trial was carried out immediately after the feeding trial. Rams were transferred into individual metabolic cages designed for separate collection of urine and faeces for 7 days. They were allowed 7 days adjustment to the cages before data collection. Feed offered, feed leftover, faeces and urine excreted were recorded daily. Daily urine samples from each ram were collected into sample bottle containing 10mls of 10% concentrated sulphuric acid to prevent loss of Nitrogen and refrigerated until required for analysis. Daily collection of faeces and urine were separately bulked and 10% aliquot was taken from each total faecal and urinary output pooled over as representative sample for chemical analyses. The nitrogen balance for WAD rams was estimated as the difference between nitrogen intake and nitrogen excreted from faeces and urine. The nitrogen retention percent was computed from the Nitrogen balance expressed as a percentage of nitrogen intake (6).

Chemical Analysis

The proximate compositions of experimental diets and faecal samples were analysed according to (7) while the fibre fractions (NDF, ADL, ADF) were according to (8). Cellulose was calculated from the difference between ADF and ADL while hemicellulose was calculated as the difference between NDF and ADF. The Nitrogen concentration in the urine was analysed also using the same method as reported by (7).

Statistical Analysis

Data obtained were subjected to one way analysis of variance (ANOVA) and significant difference between means was separated using Duncan Multiple range Test (9).

Results and Discussion

Presented in Table 2 is the chemical composition of the experimental diet. The dry matter values obtained were not relatively high but ranged from 68.69 - 79.88%. This confirmed that the sugarcane waste silage can be preserved for longer period by ensiling to increase the shelf life. (10) reported that feed with lower moisture content has higher retention in the rumen for microbial degradation. The crude protein content ranged between 13.55% - 13.77% and above the minimum crude protein requirement for normal ruminal functioning (11). The fibre fractions ADF recorded (29.9 - 4311%) in this study was slightly lower than ADF reported by (12) for sugarcane ensiled without additives. The crude fibre content ranged from 18.77% - 20.01%. The higher fibre content might be due to the fibre content of the sugarcane peels.

Table 2: Chemical composition of Experimental silage

Parameters (%)	T_1 (0%)	T2 (50%)	T3 (75%)	T4 (100%)
Dry matter	79.88	75.54	75.49	68.69
Crude protein	13.64	13.68	13.77	13.55
Crude fibre	18.80	18.77	20.01	19.98
Ether Extract	1.87	2.14	2.32	2.45
Ash	13.67	14.98	16.64	19.86
Nitrogen Free Extract	66.70	53.74	47.76	40.83
NDF	66.54	72.18	74.62	78.69
ADF	18.00	16.00	25.98	27.44
ADL	14.50	12.00	16.50	18.21
Hemicellulose	48.54	56.18	48.64	51.25
Cellulose	3.50	4.00	9.48	9.23

NDF: Neutral Detergent Fibre, ADF: Acid Detergent fibre, ADL: Acid detergent lignin

Indicated in Table 3 is Growth performance of West African Dwarf Sheep fed silage containing varying levels of sugar cane waste. There were no significant difference ($p>0.05$) in the growth parameters observed except for the final weight gain and feed conversion ratio. The average weight gain was higher in 50% inclusion level, this may be attributed to the level of the voluntary intake of the diet. (13) observed that if voluntary intake of feed by animals is too low, rate of production will be depressed. This correlation factor has thus been described as one of the factors for production in small ruminants (14).

Table 3: Growth performance of West African Dwarf Sheep fed diet containing varying levels of sugarcane waste silage

Parameters (%)	T_1 (0%)	T_2 (50%)	T_3 (75%)	T_4 (100%)	SEM±
Initial weight (kg)	12.78	13.04	12.90	12.48	0.37
Final weight (kg)	15.83^{ab}	16.52^{a}	15.57^{ab}	14.94^{b}	0.25
Weight gain (kg)	3.05	3.48	2.67	2.47	0.18
Average daily gain (g/d)	36.33	41.43	31.76	29.35	2.13
Metabolic weight gain ($w^{0.75}$ g/d)	14.78	16.29	13.32	12.52	0.66
Total feed intake (kg)	64.66	61.04	61.95	68.10	1.45
Daily feed intake (g/d)	769.76	726.67	728.50	810.74	18.10
Feed Conversion ratio	21.57^{ab}	18.03^{b}	24.39^{ab}	29.33^{a}	1.70

$^{a, b, c}$ means within rows with unlike superscripts are significantly different from each other ($p<0.05$).

Table 4 shows the Nitrogen utilization of West African Dwarf rams fed diet containing varying levels of sugarcane waste silage. There were significant differences ($P < 0.05$) on all the Nitrogen utilization parameters observed except the nitrogen intake, Nitrogen balance and absorbed. Nitrogen intake for rams on T_4 (17.57g/d) was higher with no significant difference ($P > 0.05$) among other treatments. This agreed with (14) who reported that the crude protein combination in a diet has a significant effect on the nitrogen intake of sheep. This also affected the nitrogen in faeces with 5.54g/day which differed significantly (P

< 0.05) among the treatments. This was in line with (14) that the higher protein in the diet changes the pattern of nitrogen excretions towards increasing nitrogen excretion. Nitrogen in Urine (g/d) in the silage was highest in T_3 (2.72g/d) and differed significantly (P < 0.05). This observation could be a reflective of ammonia-nitrogen concentration in the rumen that depends on the quality and solubility of the diet fed to the sheep. This could also be attributed to rapid breakdown of dietary protein to ammonia which increases nitrogenous excretion rather than contributing directly to the animal requirements (15). (16) also reported that nitrogen excreted in the urine would depend on the Urea recycling and efficiency of utilization of ammonia produced in the rumen microbes for microbial protein synthesis. Nitrogen utilization values ranged from 51.15% to 63.29% with T_2 recorded the highest value and differed significantly (P < 0.05) from other treatments. The average weight gain was higher in sheep fed 50% inclusion level, this may be attributed to the level of the voluntary intake of the diet. (16) observed that if voluntary intake of feed by animals is too low, rate of production will be depressed. This correlation factor has thus been described as one of the factors for production in small ruminants (17).

Table 4: Nitrogen utilization of West African Dwarf rams fed diet containing varying levels of sugarcane waste silage

Parameters (%)	**T_1 (0%)**	**T_2 (50%)**	**T_3 (75%)**	**T_4** (100%)	SEM±
Nitrogen Intake (g/d)	16.80	15.91	16.25	17.57	0.37
Nitrogen in faeces (g/d)	4.78^{b}	3.94^{c}	5.16^{ab}	5.54^{a}	2.33
Nitrogen in urine (g/d)	2.02^{b}	1.88^{b}	2.72^{a}	2.70^{b}	0.12
Total N-loses (g/d)	6.80^{c}	5.82^{b}	7.88^{ab}	8.24^{a}	0.27
N-balance (g/d)	10.00	10.09	8.37	9.34	0.31
N-absorbed (g/d)	12.02	11.97	11.11	12.04	0.33
N-Utilization	59.52^{b}	63.29^{a}	51.15^{c}	53.13^{c}	1.41

^{a,b,c} means along the same row with different superscripts are significantly different from each other ($p< 0.05$).

Conclusion and Applications

It could be concluded from the result of this study that:

1. Sugarcane waste could be successfully ensiled with other feedstuffs and transformed into animal feed resource without any adverse effects on their growth performance
2. Sugarcane waste at 50% exhibited the best feed conversion efficiency and positive nitrogen utilization
3. The use of sugarcane waste up to 50% inclusion level is recommended in small ruminant production especially in the dry seasons when forages are scarce and of low quality to enhance palatability and efficient feed utilization.

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