VOL. 4, NO. 10, October 2014 ISSN 2225-7217
ARPN Journal of Science and Technology

http://www.ejournalofscience.org

Feedlot Performance of Sudan Baggara Zebu Bulls Finished on Urea-Treated Sugar-cane Bagasse

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ABSTRACT

This study investigated the performance of Sudan Baggara bulls finished on sugar-cane bagasse ensiled with urea for 3 weeks. They treated sugar-cane baasse used in fattening diets at three levels (10%, 20% and 30%). The control diet contained 0% treated bagasse. All diets were adjusted to be iso-nitrogenous and iso-caloric. Thirty six Baggara bulls of a live weight that ranged from 165 to 185 kg were divided into four groups of equal live weight and number. The experimental diets were randomly distributed among the four bull groups, and the feeding was extended for 70 days. During the feeding period feedlot performance were studied. There were no significant ($P>0.05$) difference between treatments in average daily gain, final body weight and total body weight gain, but these growth parameters were superior in the treated groups than in the control. Feed intake and feed conversion ratio were improved significantly ($P<0.05$) in the diets that contained treated sugarcane bagasse in comparison with the control diet.

Keywords: *Bagasse, Daily gain, Baggara bulls, Feedlot*

1. INTRODUCTION

According to the Ministry of Livestock, Fisheries and range lands of the Sudan 2012 the livestock population of Sudan, amount to 104.7 million head of which, sheep represent 39.2, goat 30.6, camel 4.7 and cattle 29.6 million heads. These flocks are owned mainly by nomadic groups who depend on poor range land for their feeding. The annual DM requirement of these flocks is estimated as 214 million tons; while the annual DM production in the country is about 105 million tons [2]. Roughly feeding animals in Sudan especially in urban areas depends totally upon fodder crops and agro-industrial by-products such as sugarcane bagasse, wheat straw, sorghum straw, groundnut hulls and cotton by-products. These by-products are also used in drought season for feeding ruminants in rural areas when forage is in short. Low quality forages and agricultural by-product leads some times to fattening livestock using sorghum grains and oil seed cakes at ratio of 50% each which increase cost of production [19] Low quality forages are less than 55% digestible and are deficient in true protein (less than 80g crude protein/kg) and low in soluble sugar and starches (less than 100g/kg) [16]. They are also characterized by low content of minerals and vitamins as well as high content of indigestible fiber due to lignifications of cellulose. Consequently these forage are less palatable and of low intake by animals [22]. To improve the digestibility of agricultural by-products, chemical treatments are used. [22], [5] and [3] reported that urea treatment improved digestibility and crude protein content of sugar-cane bagasse. In this study Sugar-cane tops treated with urea was used to fatten Baggara Zebu bulls opting to reduce the cost production and the competition between man, chicken and animals for agro-industrial products as cereal crops and oil seed cake.

2. MATERIALS AND METHODS

2.1 Animals

Thirty six Baggara Zebu bulls (Nyalawi type) with an average initial live weight of 170kg were used for this study. These animals were purchased from the central livestock market at Omdurman city and trekked to the site of study at the Animal Production Research Centre (Helat Kuku) Khartoum north. They were kept for an adaptation period of two weeks and offered a mixture of equal proportions of the experimental diets. During the adaptation period bulls were ear tagged, vaccinated and treated against internal and external parasites. Then they were weighed and divided into four groups of equal number and weight. Group was further subdivided into three subgroups of three animals each, having equal average weights. Each subgroup was kept separately in a pen provided with water, feed facilities and salt lick.

2.2 Feed and Feeding

Sugar-cane bagasse (ensiling for 3 weeks following addition of 10% urea, 5% molasses and 1% bicarbonate) was used to prepare the fattening diets. The diet, contained increasing levels of treated bagasse (0, 10, 20 and 30%) in addition to other feed ingredients. The diets were formulated to be iso-caloric and iso-nitrogenous table (1). The chemical composition of the different diets is given in table (2). The experimental diets were divided randomly into the animal groups. Animals in

the first group (control) were given 80% of diet in addition to 20% sorghum straw. The second, third and fourth groups of animals were given diets B, C and D which respectively contained 10, 20 and 30% of treated bagasse. In addition all animals were offered green fodder Medicago sativa at the rate of 2kg / head / week. The diets were offered once daily at 8:00 am after the refusals were collected. Water and salt lick were available all the times. The experimental period lasted for 70 days after the adaptation period.

2.3 Digestibility Trial

The in vitro digestibility (two-stage) method was applied to determine the dry matter and organic matter digestibility of the experimental diets according to [23].

Table 1: Ingredients proportion of the experimental diets

	Experimental diets			
Ingredients	A (%)	B (%)	C (%)	D (%)
Treated Bagasse	0	10.00	20.00	30.00
Wheat bran	39	29.00	24.00	18.00
Groundnut cake	5	10.00	10.00	10.00
Molasses	52	39.00	33.00	27.00
Sorghum grain	0	8.00	10.00	12.00
Urea	3	1.00	1.00	1.00
Limestone	0	2.00	1.00	1.00
Salt	1	1.00	1.00	1.00
*Calculated ME (MJ/kg)	10.21	10.79	10.52	10.13
Calculated CP (%)	16.84	16.65	16.72	16.61

* Calculated according to MAFF (17)

Table 2: Chemical composition of experimental diets

	experimental diets			
Parameter (%)	A	B	C	D
Dry Matter	91.14	92.59	92.70	92.85
Ether Extract	1.70	2.21	2.84	2.10
Crude protein	17.31	16.02	17.48	17.04
Crude fiber	10.91	11.53	11.91	13.98
Nitrogen Free Extract	52.54	52.86	51.99	51.46
Ash	8.03	8.59	8.15	7.50

2.4 Feedlot Performance

Data collected were, feed intake which was recorded daily and calculated as the difference between the weight of the quantity offered and refusal on the next morning. The average dry matter of the experimental diet and the refusal were obtained to calculate dry matter intake. Initial live-weight was recorded on the first day of the experiment. Animals were weighed weekly early in the morning after an overnight fasting except for water using\ Weigh Bridge of 1500kg maximum capacity load with 5kg divisions. Daily weight gain, total weight gain, metabolic body weight and feed conversion ratio (FCR) were then determined.

2.5 Statistical Analysis

Data were analyzed by analysis of variance (ANOVA) according to [14] for a complete randomized design. When the F test was significant, the means were compared using least significant difference (LSD).

3. RESULTS

3.1 Digestibility of the Experimental Diets

The in vitro digestibility (two-stage) of the experimental diets is summarized in table (3). The dry matter digestibility (DMD) and organic matter digestibility (OMD) of the diets were found to be not significantly different for all treatments. The results show that increasing the level of treated sugar-cane bagasse to 30% in the diet lead to a decrease the DMD and OMD. Diet B had the highest value (75.97%) for DMD and diet A had the highest value for OMD, while group D had the least digestibility for both DMD and OMD. The digestibility of crude fiber in the experimental diets decreased with increasing level of treated sugar-cane bagasse in the experimental diets and the difference was only significant ($P<0.05$) between diet D and the other diets.

3.2 Feedlot Performance

Feedlot performance of Baggara Zebu bulls under study is presented in table (4). The average initial live weight among all groups showed no significant difference ($P>0.05$). The final body weight of experimental groups was also not significantly different. Final live weight was higher (255.56kg) in group B (10% level of bagasse) and the least final body weight (248.33kg) was found in group A (0% level of bagasse). Final body weight of group C (20% level of bagasse) and

D (30% level of bagasse) were almost similar. In all bull groups fed diets containing treated bagasse, final live weight was greater than that of the control group fed a diet denied of bagasse. Average daily live weight gain showed the same trend as final body weight and was not found to be significantly different (P>0.05) for all treatments. The highest daily gain was for group B (1.23kg) flowed by group D, C and A. Total live weight gain showed no significant difference between treatment groups. The total live weight gain of group A which was a diet that contained 0% treated sugar-cane bagasse was the least and group B (20% treated sugar-cane bagasse) was the highest. Both daily gain and total live weight gain were the least in group A which was the control group. Daily dry matter intake (DMI) among treatments groups was significantly (P<0.05) influenced by the level of treated sugar-cane bagasse in the diet, table (4). The group fed 0% treated sugar-cane bagasse (group A) showed the highest value as 7.93 kg while the group fed 20% treated sugar-cane bagasse revealed the least value as 6.99. Bulls fed 10% or 30% levels of treated sugar-cane bagasse in their diets consumed similar amount of dry matter. Average daily feed intake calculated on as fed base revealed significant difference (P<0.05) among treated groups. The highest value was reported for group A and the least value was in group C. Group B and C had similar amount as fed feed intake. Feed conversion efficiency was significantly (P<0.05) inferior in the control bulls group (A) than in other bulls groups (B, C and D). Within the later three groups bulls fed the diet that contained 30% level of treatment sugar-cane bagasse showed significantly (P<0.05) inferior feed conversion ratio.

Table 3: the in vitro digestibility (two-stage) of experimental diets

Diets	Parameters		
	DMD	OMD	CFD
A	75.05	77.22	44.98[a]
B	75.97	76.71	43.54[a]
C	75.28	76.15	43.11[a]
D	73.26	74.97	39.51[b]
SE	1.39	1.25	1.25
P value	N.S	N.S	*

DMD: Dry matter digestibility.
OMD: Organic matter digestibility.
CFD: Crude fiber digestibility.

Table 4: Feedlot performance of bulls fed diets containing graded levels of treated sugarcane bagasse.

Parameter	Experimental diets				SE	P value
	A	B	C	D		
No. of animals	9	9	9	9		
Period in day	70	70	70	70		
Initial body weight (kg)	170.56	169.44	171.11	170.00	3.74	NS
Final body weight (kg)	248.33	255.56	251.11	251.67	6.64	NS
Metabolic body weight ($kg^{0.75}$)	63.96	63.77	63.81	63.96	1.28	NS
Total body weight gain (kg)	77.78	86.11	80.00	81.67	3.79	NS
Average daily gain (kg)	1.10	1.23	1.14	1.17	0.08	NS
Average daily feed intake (as fed/kg)	9.91[a]	9.32[b]	8.74[c]	9.34[b]	0.12	*
Average daily dry matter intake (kg)	7.93[a]	7.46[b]	6.99[c]	7.47[b]	0.11	*
Dry matter intake as % of body weight	3.19[a]	2.92[b]	2.78[c]	2.97[b]	0.04	*
Feed conversion ratio (kg DMI/gain)	7.21[a]	6.21[c]	6.35[c]	6.80[b]	0.10	*

4. DISCUSSION

4.1 The Digestibility of the Experimental Diets

The in vitro technique used in this study showed no significant (P>0.05) differences in the digestibility of dry matter (DM) and organic matter (OM) among the dietary treatments. However, DMD and OMD decreased with increasing level of treated sugar-cane bagasse in the diets compared with the control diet. The crude fiber digestibility (CFD) was found to decrease and the decrease was significant at 30% level of inclusion (Diet D) of treated sugar-cane bagasse. This could be due to fiber content which was higher in diets contained treated sugar-cane bagasse particularly diet D than the control diet (Table 2). [10] Stated that the CF content had negative effect on digestibility. The improved digestibility of crude fiber of the control diet could be due to less lignified crude fiber of the wheat bran of this diet than that of Sugar-cane bagasse in the other diets and to increased rumen degradability of cell wall components resulting from better microbial activity as a result of nitrogen supply as well as energy supply which were readily available in control diet due to the high levels of molasses and urea ingredients in this diet (Table 1). Numerically the DMD, OMD and CFD obtained for the control diet were slightly lower than those obtained by [12] for the same diet. This discrepancy might be due to the method applied to determined digestibility. Two-stage (in vitro) method was applied in this work for digestibility study while the later author used in vivo method. In addition to that the DMD, OMD and CFD of the diet containing 10, 20 and 30% treated sugar-cane bagasse were higher than that of diets have the same levels of raw bagasse in [12]. These findings might be due to the improvement set on sugar-cane bagasse by urea treatment and ensiling. This result was in agreement with [13] who treated sugar-cane bagasse with 5% ammonia and found increased digestibility of DM, OM and cellulose. Many authors indicated that urea or ammonia treatment of roughages increased the digestibility coefficient of straw and other agricultural by-products [15], [22] and [5].

4.2 Feedlot Performance

As presented in table (4) feed intake was affected significantly ($P<0.05$) by the level of treated sugar-cane bagasse in the diet. The average feed intake was higher in the group fed molasses based diet (A) compared to other groups and that increasing level of treated sugar-cane bagasse up to 30% in the diet (diet D) lead to lower feed intake. The increased crude fiber content and the decrease in the digestibility might be responsible for the decreased feed intake. Feed intake in beef cattle is influence by many factors one of these is diet digestibility [8]. [12] who fed increasing levels of raw sugar-cane bagasse to the same breed of Zebu cattle and found a decrease in feed intake as bagasse level increased in the diet and attributed the decrease in feed intake to the decrease in diet digestibility. Numerically the present findings of average daily feed intake and DMI of Baggara Zebu bulls was within the rage stated by [24] and [11]. However these values were slightly higher than those obtained by [12]. Possibly due to the improved palatability of treated sugar-cane bagasse due to urea treatment. Final body weight showed no significant difference between treatments. Final body weight of the groups fed diets with treated sugar-cane bagasse was greater than that in control group fed a diet with no bagasse. The present findings indicated that total live weight gain was also greater in bull groups finished on diets that contained increasing levels of treated sugar-cane bagasse than in group (A) which was fed molasses based diet that contained no sugar-cane bagasse. The Average daily gain in this study showed the same trend as final and total live weight gain. [21] Reported that cattle on urea treated rice straw with only small amount of by-pass protein increased live weight gain. This could explain the higher weight gain observed in this study. The results of final body weight, total body weight and daily gain obtained in this study were higher than those reported by [12] who finished Baggara Zebu bulls on increasing levels of raw sugar-cane bagasse. Gain and efficiency are affected by feed intake as [20] stated that animals which eat more will produce more. Dry matter intake was higher in this study than what reported by [12] which might be due to the effect of urea treatment on improving sugar-cane bagasse digestibility. Average daily live weigh gain obtained was in the range reported by many authors for Baggara Zebu bulls [1] and [7]. However daily live weight gain in this study was found to be slightly lower than that reported by [12] and [18]. These differences might be due to many factors as initial weight, type of feed, season of fattening and others environmental factors. Feed conversion ratio (FCR) in this study was significantly ($p<0.05$) affected by levels of treated sugar-cane bagasse in the diet. Feed conversion efficiency of bulls fed diets containing treated sugar-cane bagasse was significantly (($p<0.05$) superior than that of control bulls. Within diets containing treated sugar-cane bagasse feed efficiency declined with increasing levels of bagasse and the decline was significant ($p<0.05$) between the group fed the diet containing 30% treated sugar-cane bagasse and those fed diets with 10 and 20% treated sugar-cane bagasse only. Numerically the figures in these findings were in agreement with [6] and [4]. The feed conversion ratio is affected by feed intake and daily gain. [9] stated that FCR was affected by type of feed and improved significantly by high concentrate diet compared to high roughages diet. In the present study the improvement in FCR might be due to improvement in treated sugar-cane bagasse digestibility. [12] Fed Baggara bulls 0, 10, 20 and 30% levels of raw sugar-cane bagasse and reported FCR as 5.15, 5.02, 6.09 and 7.35 kg/DM/ kg gain. The findings of this work were superior than that reported by [12] and might be attributed to the improved rate of gain in this study.

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