A Seminar paper

on

Problems and prospects of Sugarcane bagasse as a Roughage Feed for Ruminants

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Problems and Prospects of Sugarcane bagasse as a Roughage Feed for Ruminants.

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Abstract

The aim of this study was to highlight different properties of sugarcane bagasse, problem and prospects of feeding different concentration level of sugarcane bagasse. The bagasse has been a valuable alternative, low cost, unique viable roughage available feed for ruminants. But it's low nutritional quality high cellulose, hemicellulose content feed so it cannot fed animal more. If sugarcane bagasse is fed less amount the result is similar to the control diet and increase apparent digestibily, growth rate, milk production, but if feeding more milk production is decreases ,causes metabolic disorder and also growth rate is hampared.

Key word: sugarcane bagasse, cellulose, hemicellulose, apparent digestibility

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CHAPTER 1
INTRODUCTION

Bangladesh is an agricultural country where most of the people directly or indirectly engaged with agriculture. The most important part the agriculture is animal rearing. The major problem of animal rearing is shortage of feed, high feed cost and all feed are not available all the year. But the demand of animal products is increasing day by day so there is a need to develop new feed sources which are less cost, more available and nutritional quality are good. Sugarcane bagasse is an important feed which is less cost and available.

Bagasse is a lignocellulosic residue of the sugar industry, which consists of around 40–50% cellulose, 20–30% hemicellulose, 20–25% lignin and 1.5–3% ash or generally it can be say that it contains 50% fiber, 48% moisture and 2% sugar which couldn't be extracted (Chauhan, et al., 2011). It has high energy content (Drummond and Drummond, 1996). It assumes an imperative part to satisfy the vitality prerequisite for creating nations like India, Brazil and so forth., where huge measure of sugarcane are delivered. After Brazil, India is second significant producer of sugarcane on the planet. In year 2011–2012 around 330.36 million metric tons of sugarcane was produced on 4.71 million hectares of land, with an average yield of 70.07 tons/ha (USDA Gain Report). Generally, one ton of raw sugar-cane produces around 100 kg of sugar, 270 kg of dry bagasse and 35 kg of molasses (Garcı`a-Pèrez, et al., 2002a). For the most part, bagasse is utilized as a fuel hotspot for boiler in sugar plants. Be that as it may, this isn't completely utilized as a wellspring of vitality in sugar factories, since it makes the waste administration issue at process site. In addition, the direct combustion of bagasse in boilers has efficiency of only 26%, as well as the burning of bagasse in the boilers form airborne fly ash, which is responsible for major health hazard (ASTM D1102 – 84, 2013; ASTM E872 – 82, 2013; Gagliano, et al., 2017; Mavukwana, et al., 2010.

Many sugar milling factories around the world release large quantities of bagasse as a part of their byproducts, some even dispose it as a waste. Traditionally, past research has more or less focused on utilization of bagasse for production of energy, fabrication boards and paper manufacture as well as for the production of insulation materials. In addition the one major potential use of bagasse is as a feed stuff for cattle (Rivers, 1988). However its low digestibility limits its use in the row state (Anakalo and *Corresponding Author E-mail ahmedgofoon9@yahoo.com Anakalo,2009). Bagasse is used as a basal diet, it's important to give the correct supplementation in order to obtain satisfactory physical and economic responses. The supplementation must take account of the productivity of the animals (e.g. Growing fattening, lactating, and etc.), (Mahala et al., 2007

Low quality sugarcane bagasse requires, however, the use of great amounts of concentrate to maintain milk production, but most studies with this roughage were conducted with beef cattle. For dairy cattle, exacerbated amounts of concentrate can bring damage to milk production and causes metabolic disorder. Thus , it was hypothesized that the establishment of a proper roughage to concentrate rato, using sugarcane bagasse as a exclusive roughage for dairy cows, could promote improvements in dairy performance and sustainability of livestock production in braziian semiarid.

OBJECTIVES

1.To evaluate the prospect of sugarcane bagasse when it uses as a roughage feed for ruminants
2.To identify the problems of feeding sugarcane bagasse in different concentration level.

CHAPTER 2

MATERIALS AND METHODS

The seminar paper is exclusively a review paper. All data and information is collected from secondary sources like various articles published in different journals, books, reports, publications, website ,help of my respective major professor and honorable course instructor, So there is no specific method of studies are not involved to prepare this paper. After collecting necessary information , it has compiled and arranged Chronologically for better understanding and clarification.

CHAPTER 3

RESULTS AND DISCUSSION

3.0. PRODUCTION

Production of sugarcane in worldwide (http://www.agritech.tnau.ac.in)

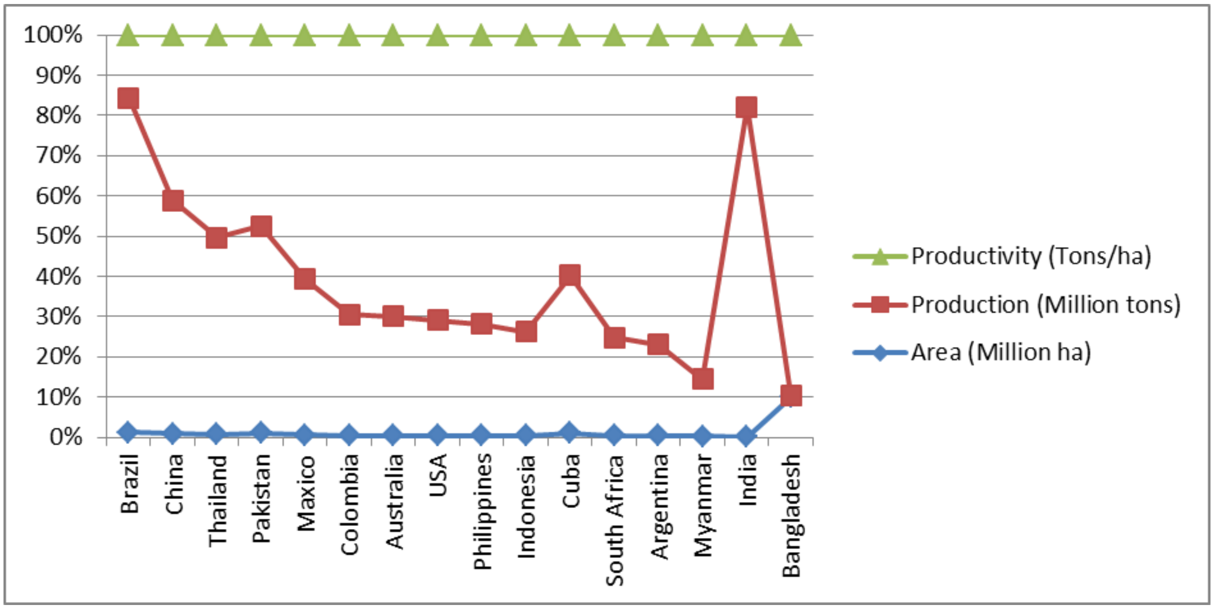
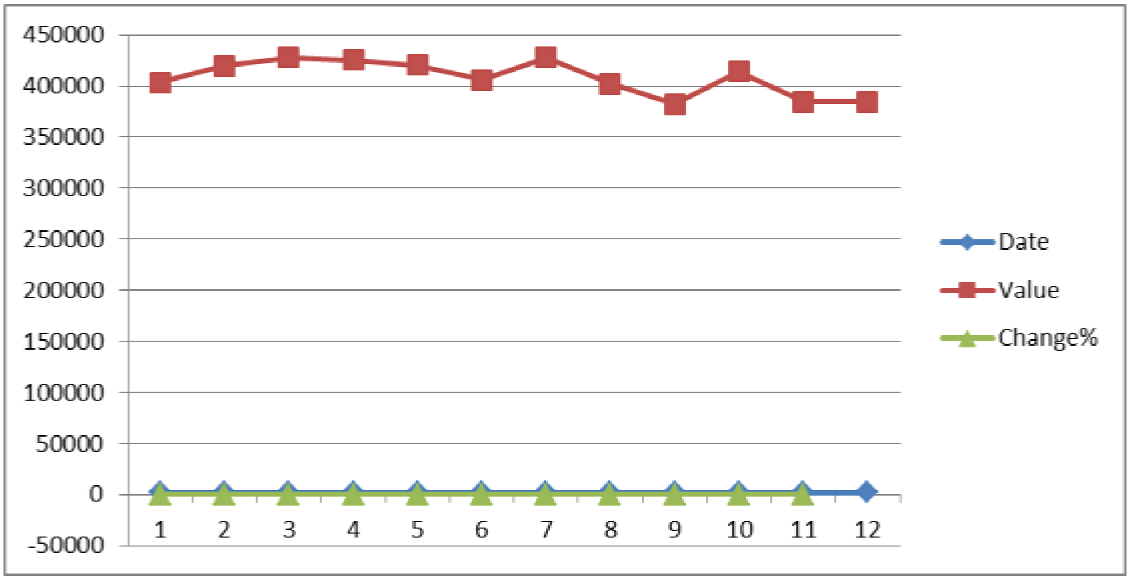


Figure 1: Production of sugarcane in worldwide (http://www.agritech.tnau.ac.in)

Figure:2 Sugarcane yield in Bangladesh



Source:knoema.com)

In 2018, sugar cane yield for Bangladesh was 403,608 hg per ha. Though Bangladesh sugar cane yield fluctuated substantially in recent years, it tended to decrease through 1969 - 2018 period ending at 403,608 hg per ha in 2018.

3.1: India is second largest sugarcane producer in the world. Major growing area is Utter Pradesh, Maharashtra and Tamil Nadu. Chhattisgarh is conceder as minor growing area. Due to good rain fall in Chhattisgarh (791 mm in Kabirdham http://agricoop.nic.in) production is growing year to year.

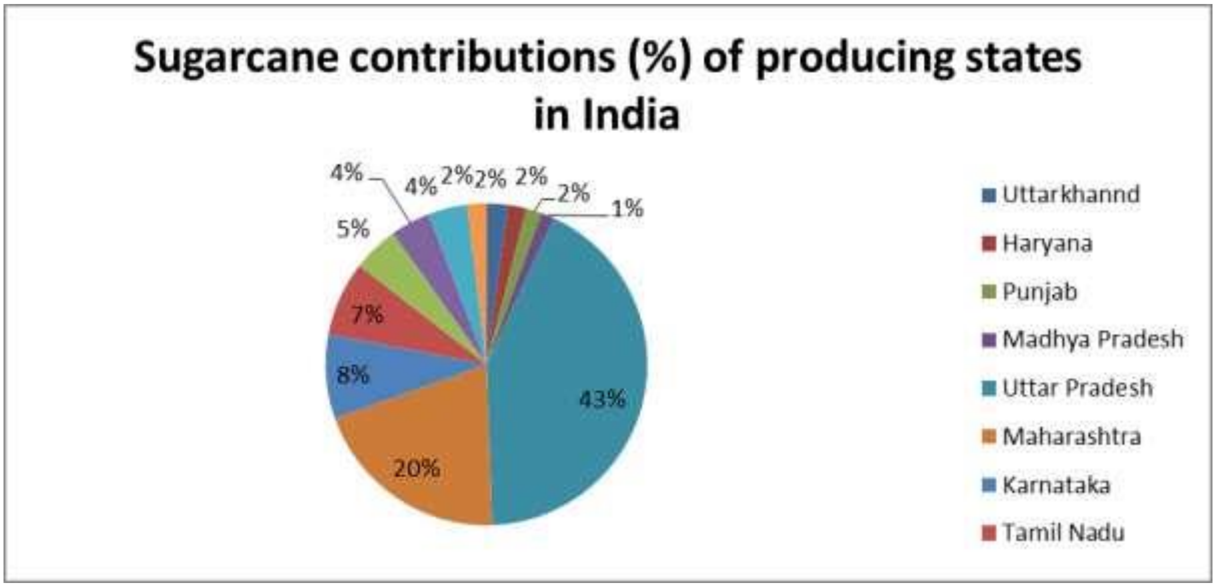


Figure 3: The sugarcane producing states
[http://vsisugar.com/india/statistics/areaundersugarcane.htm

3.2: Proximate properties of sugarcane bagasse

Many reports on the proximate properties of SB had been published and a few are listed in Table 1 for comparison with the Malaysian SB. Generally the proximate properties varied according to countries; the effects of location, climate, and species were significant. The variation also suggested that there should be differences in the functional properties as they are strongly associated with the proximate properties; e.g. emulsifying activity to protein content (2)

The SB in this study was from yellow canes, the most popular cultivar grown for juice production in Malaysia. The canes were harvested 8-9 months after sowing; the optimum harvesting period for good juice yield had been reported to be between 7 and 8 months (21). The proximate properties gave indications on how SB could benefit food products when used as an ingredient. Low moisture content suggested the ability to prolong storage life by preventing

Table 2. Proximate properties of sugarcane bagasse**.**

This study		References 9	13	14	15	16	17	18
Origin	Malaysia	Brazil*	India	Thiland	Costa Rica	Us*	Venezuela	Brazil
Proximity properties Moisture content (%)								
-Fresh bagasse	63.0 ± 0.81	-	-	45.0	45.0-50.0		-	-
-Vacuum-packed powder	9.4 ± 0.05	-	-	-	-	50.0	9.4	-
Protein (%)	1.7 ± 0.10	-	3.4	1.4	2.0-3.0	1.6	2.0	2.4
Crude fat (%)	2.0 ± 0.00	-	1.0	0.35	=1.0	-	-	0.3
Crude fiber (%)	30.4 ± 0.05	-	41.9	22.1	43.0	-	-	-
Ash (%)	1.01± 0.09	= 24	5.0	1.5	3.0-4.0	2.0	4.3	3.2
Crude carbohydrate (%)	55.4 ± 0.61	-	48.7		=50	-	-	-
Cellulose (%)	-	= 50.0	40.3	-	-	50.4	33.3	-
Hemicelluloses (%)	-	= 25.0	25.8	-	-	28.5	22.6	-
Ligin%	-	= 25.0	3.3	-	-	14.9	6.2	25.4

(Source:Agro food industry hi-tech march/April 2011)

microbial growth and spoilage; low crude fat meant SB could be incorporated into low fat food with reduced calories value (6). Relatively high crude fibre content recommended its use in fibre rich food, where SB could help increase fecal bulk and speed up food passage through the human digestive tract (1, 22). And due to high carbohydrate level, SB could be integrated into baked products. The setbacks were that SB could not give mouth feel sensation and texture due to low crude fat (23), could not be used for mineral supplement due to low ash content (24), and could cause protein deficiency as food with less than 7 percent crude protein induces this adverse effect.

3.3: Dietary fibre compositions of sugarcane bagasse

In the course of this research, information on the total dietary fibre (TDF), insoluble dietary fibre (IDF), and soluble dietary fibre (SDF) of SB was unavailable in the literature. Table 2 shows the dietary fibre compositions of the Malaysian SB and some fibre sources of different nature. The TDF of SB (79.5 g/100g) was superior to those of fibres from fruit peels, seeds, carrot peel, and

seaweeds, indicating its competency as dietary fibre source, though the TDF was generally lower than those of established commercial fibres like hydrocolloids, oligosaccharide, and cereal fibres.

The dietary fibre of SB was mainly IDF (75.7 g/100g), predominantly caused by its high cellulose, hemicellulose and lignin contents. While the IDF was lower than those of cereal fibres, apple pomace, bamboo, and date flesh concentrate, it was higher than the IDF of the rest of the fibre sources in Table 3.

Table 3. Dietary fibre compositions of sugarcane bagasse and other fibre sources.

Fiber sources	TDF (g/100g)	IDF (g/100g)	SDF (g/100g)	References
Sugarcane bagasses	79.5 ± 0.5	75.7 ± 0.7	3.8 ± 0.2	This study
Hydrocolloid				
Guar gum	85.0	0.0	85.0	3
Locust began gum	78.0	0.0	78.0	3
cellulose powder	98.0	1.0	97.0	3
Oligosaccharide				
Inulin	97.0	0.0	97.0	3
Cereal fibre				
oat 600	96.0	93.0	3.0	3
Wheat	97.0	94.5	2.5	3
Fruit and tree fibre				
Apple	60.0	45.0	15.0	3
Apple pomace	89.8	81.6	8.2	4
Bamboo	97.0	97.0	0.0	3
Date flesh concentrate	92.4	84.7	7.7	19
Grapefruit peel	62.4	56.0	4.6	4
Lemon peel	68.3	62.0	6.3	4

(Source:Agro food industry hi-tech march/April 2011)

However, the SDF was low at 3.8 g/100g. The relatively high TDF and IDF of SB conjectured about its use as a dietary fibre source; dietary fibre benefits consumers by promoting peristalsis movement, reducing intestinal transit time, limiting constipation by increasing fecal bulk weight by 5-9 percent, and reducing food calorie content by acting as bulking agent (1, 20). SB could be employed as functional ingredient in confectionary, bakery, low-fat-high-fibre dietetic products, and weight-loss diet because dietary fibre carries no calories and could provide satiety and fullness feeling, preventing consumers from consuming high calories food (6, 22).

3.4: Functional properties of sugarcane bagasse

Table 3 shows the functional properties of SB and other fibre sources. The swelling capacity (SC) for SB was moderate among the fibre sources, while the water holding capacity (WHC) and water retention capacity (WRC) were among the lowest. The WHC reported by Sangnark and Noomhorm (11) was higher than the value in this study, predominantly due to smaller particle size; WHC increased as particle size decreased (20). SC, WHC, and WRC are widely studied as water plays essential roles in food processes, viz starch gelatinization, protein denaturation, yeast and enzyme activation, and flavour and colour formation. High values are often required; for instance, high WRC can reduce starch gelatinization and affect postprandial sugar availability in food like bakery goods (3). For such cause, SB may not be a suitable ingredient. However, it is worthy to note that the SC of SB was comparable to established cereals like oat and wheat.

The oil holding capacity (OHC) of SB was superior at 9.4 g oil/g sample. It was higher than the value reported by Sangnark and Noomhorm (11), probably due to the difference in particle size.,

Table 4. Functional properties of sugarcane bagasse and other fibre sources.

Fiber sources	Particle size (µm)	SC (mL/g)	WHC(g/g)	WRC(g/g)	OHC(g/g)	OMAC(g/g)	EA(%)	ES(%)	Ref
Sugarcane bagasses	< 813 <300	7.0±0.00	3.2±0.04 5.0	3.1±0.04	9.4±0.53 3.3	8.3±0.06	n.d	n.d	This study
Hydrocolloid									11
Cellulose powder	164	6.2	5.6	4.0					3
Oligosaccharide									
Inuline	85	11.8	11.1	1.2					3
Cereal fibre									
Oat 600	63	7.6	6.9	4.8					3
Maize hull				2.3		1.6			2
Wheat	61	7,1	6,5	4.2					3
Wheat hull				2.5		2.0			2
Fruit and tree fibre									
Apple	96	6.9	6.1	3.9					3
Apple pomace	500-600	6.6-8.3		1.6-1.9	0.6-1.5				4
Bamboo	34	5.7	4.8	3.5					3
Date flesh concentrate				15.9	9.9				19
Grapefruit peel	500-600	6.7-8.0		2.1-2.3	12-15				4
Lemon peel	500-600	7.3-9.2		1.7-1.9	13-15				4
Oramge peel	500-600	6.1		1.7	1.8				4
Seeds/ Beans									
Chia fibre rich fraction	< 140			15.4	2.0	1.1	53.3	94.8	2
Cocoa fibre	75	6.5		4.8					6
Cocnut fibre	550	20.0	7.1	5.3	4.8				20
Jack bean residure	≤ 376			0.4	0.2		8.6	100.0	1
Jackfruit seed powder	< 813	5.8	6.0	3.8	1.1	0.7			5
Lima bean residure	≤ 376			0.3	0.2		49.3	28.3	1
Palm kernel cake	< 500	3.5		3.2	2.0		44.0	44.0	25.26
Passion fruit reskuje						0.3	52.6	100.0	2
Vegetable waste									
Carrot peel	63-450	19.0-24		15.5-19.6					7

(Source:Agro food industry hi-tech march/April 2011)

However it remained unknown as to why a decrease in particle size led to an increase in WHC but a decrease in OHC. High OHC gave good indication that SB could stabilize food that contains high fractions of fat and emulsion (19). The main setback to high OHC was that when incorporated into fried products, SB could give unwanted greasy sensation (2). The organic molecule absorption capacity (OMAC) of SB was highest at 8.3 g oil/g sample. The main reason was attributed to the relatively high IDF and lignin contents in SB; IDF and lignin were reported to be the chief components for organic molecule absorption (2).

High OMAC implied that SB could yield physiological benefits in terms of the elimination and absorption of fats, biliar acids, cholesterol, and toxics in the small intestines and from feces (2).

The emulsifying activity (EA) and emulsifying stability (ES) of SB were undetectable; SB did not facilitate the dispersion of water and oil after being subjected to homogenization up to 4000 revolutions per minute. The low protein content in SB (1.7 percent) was the primary cause, as protein is a good emulsifying agent (2). This meant that SB could not be useful as ingredient for food developed for long-period storage because high EA is a prerequisite (1, 2).

3.5: EFFECT OF FEEDING SUGARCANE BAGASSE ON INGESTIVE BEHAVIOR

The ruminating and idle time for cows fed 45%, 50%, and 55% of sugarcane bagasse was the same as that related to the control diet. For 60% of bagasse inclusion, the ruminating time was lower and the idle time was greater than the control diet ($p<0.05$). It was observed same results on feeding efficiency for 45%, 50%, and 55% bagasse levels and control diet. Ruminating efficiency was the same between 45% and 50% of bagasse inclusion and control diet. Ruminating time and efficiency of feeding and rumination decreased, while the idle time increased linearly with sugarcane bagasse inclusion in diets ($p<0.05$).

Table 5: Ingestive behavior of caws fed sugarcane bagasses

Item	Control			Sugarcane	Bagasse(%)	SEM	P value	
		45	50	55	60		L	Q
Time								
Feeding	322	306	287	294	307	0.183	0.844	0.162
Ruminating	621	667	652	605	541*	0.099	<0.001	0.048
Idle	497	467	501	541	592*	0.180	<0.001	0.332
Efficiency (kh DM/h)								
Feeding	284	2.88	2.95	2.68	2.24*	0.144	0.003	0.095
Ruminating	1.88	1.90	1.70	1.45*	1.17*	0.379	<0.001	0.332

(Source:Almeida et.al.2018)

3.6: EFFECT OF SUGARCANE BAGASSE IN NUTRIENT INTAKE AND APPARENT DIGESTIBILITY

The DM, organic matter (OM) and TDN intakes and DM and OM digestibilities of cows fed 45% and 50% sugarcane bagasse were similar to control diet (p>0.05) while for cows fed 55% and 60% levels of bagasse were lowest (p<0.05). The intake and digestibility of CP diets with 45%, 50%, and 55% of sugarcane bagasse were the same related to control diet (p>0.05). The non-fiber carbohydrate intake and digestibility for cows fed 45% of bagasse were similar for control diet (p>0.05). The neutral detergent fiber assayed with a heat stable amylase and corrected for ash and nitrogenous com- pounds (aNDF[n]) and NDF indigestible intakes and aNDF(n) digestibility differ for all sugarcane bagasse inclusion related to control diet (p>0.05).

A linear decrease was observed to intakes and digestibilities of nutrients with the bagasse levels (p<0.05), except for aNDF(n) and NDF intakes and aNDF(n) digestibility.

Table 6: Nutrient intake and apparent digestibility in cow fed sugarcane bagasse

Item	Control	Sugarcane bagasse (%)				SEM	P value	
		45	50	55	60		L	Q
Daily intake(kg/d)								
Dry matter	15.1	14.6	13.9	12.9*	11.3*	0.335	< 0.001	0.187
Organic matter	13.9	13.9	13.4	12.3*	10.8*	0.314	< 0.001	0.176
Crude protein	2.11	2.24	2.14	2.00	1.78*	0.043	< 0.001	0.239
aNDF(n)	3.17	5.17*	5.30*	5.22*	4.98*	0.182	0.430	0.320
iNDF	2.07	2.47*	2.68*	2.68*	2.54*	0.090	0.607	0.079
NFC	7.47	5.91	5.25*	4.48*	3.58*	0.078	< 0.001	0.136
TDN	8.84	9.40	8.38	7.18*	5.91*	1.318	<0.001	0.153
Daily intake(g/kg of BW)								
Dry matter	3.63	3.25	3.11	2.86*	2.51*	0.074	<0.001	0.186
aNDF(n)	1.02	1.29*	1.32*	1.29*	1.21*	0.045	0.227	0.242
Total apparent digestibility(g/kg)								
Dry matter	688	693	653	603*	514*	1.45	<0.001	0.108
NnEFFECT Organic matter	739	726	702	659*	579*	1.03	<0.001	0.014
Crude protein	799	796	790	789	726*	1.52	0.005	0.072
aNDF(n)	310	581*	528*	494*	428*	2.81	0.003	0.640
NFC	772	700	662*	574*	487*	2.70	0.001	0.941

(Source:Almeida et.al.2018)

3.7. Rice straw and sugarcane bagasse mixed diet

Fungi zoospores counts were enhanced (*P*<0.05) in cattle fed with SBU and SBUC as main roughage source (Table 5). The alkali in the lignocellulosic material induces the swelling of the material, increasing the internal surface, and reducing the polymerization degree and crystallinity, which resulted in the rupture of the lignin (Castañón-Rodríguez et al. 2015). This effect avails the rumen microbes to attack the structural carbohydrates more easily and improved digestibility, as well as the palatability of treated straw (Bod'a 1990). Vinh et al. (2011) showed that when feeding 2 % urea + 2 % $Ca(OH)_2$treated straw could enhance fungal population ($P<0.05$). In addition, Chen et al. (2008) also reported that chemical treatments enhanced the nutritive value of roughage through increasing the number of accessible sites of microbial attachment on the surface of the particles and increasing fibrolytic microbe quantity, hence fibrolytic enzyme activities and the overall rumen fermentation characteristics.

Table 7 : Effect of the rice straw and sugarcane bagasse diets on microbial population in the rumen

Items	RS	SB	SBU	SBUC	SEM	RS vs. SB	SBU vs. SBUC	SB vs. SBU SBUC
Direct count, cell/ml								
Protozoa, $\times 10^5$								
0 h post feeding	2.8	3.2	3.2	3.1	0.44	Ns	ns	ns
4	4.1	3.8	4.6	4.7	0.25	Ns	ns	ns
Mean	3.4	3.6	3.9	3.9	0.29	Ns	ns	ns
Fungi, $\times 10^6$								
0 h post feeding	3.1^b	3.6^b	4.8^{ab}	6.1^a	0.45	Ns	ns	*
4	3.0^c	4.0^{bc}	5.6^a	4.6^b	0.29	Ns	*	*
Mean	3.1^b	3.8^b	5.2^a	4.8^{ab}	0.36	Ns	ns	*

Values on the same row with different superscripts differed ($P<0.05$) *ns* not significant

3.8: EFFECT OF SUGARCANE BAGASSE ON PERFORMANCE, MILK COMPOSITION, BLOOD AND UREA NITROGEN AND MICROBIAL PROTEIN SYNTHESIS OF COWS

The daily milk production for cows fed 45%, and 50% was similar as that of cows fed control diet ($p>0.05$; Table 5), while for those fed 55%, and 60% levels of sugarcane bagasse, the production was lower. The fat, protein, lactose, and total solids of milk were the same for bagasse levels and the control diet ($p>0.05$). The urea in the milk and plasma were greater for cows fed sugarcane bagasse diets related to control diet ($p< 0.05$).

Table 8: Performance, milk composition, blood and milk urea nitrogen and microbial protein synthesis of cows fed sugarcane bagasse

Item	Control			Sugarcane bagasse(%)		SEM	P value	
		45	50	55	60		L	Q
Performance								
Milk (kg/d)	12.0	12.1	11.2	10.3*	9.14*	0.189	<0.001	0.711
FCM (kg/d)	12.8	12.8	12.2	11.4	9.51*	0.294	<0.001	0.256
Feed efficiency (kg FCM/kg DM intake)	0.85	0.87	0.87	0.88	0.84	0.456	0.685	0.178
Milk composition								
Fat (g/100 g)	4.46	4.35	4.61	4.76	4.30	0.094	0.988	0.071
Protein (g/100 g)	3.84	3.67	3.72	3.75	3.74	0.069	0.687	0.820
Lactose (g/100 g	4.43	4.50	4.49	4.48	4.43	0.015	0.149	0.587
Total solids (g/100 g)	13.7	13.5	13.9	14.0	13.5	0.150	0.861	0.154
Allantoin (mmol/d)	43.8	42.6	41.3	34.7*	30.1*	1.450	<0.001	0.225
Urea nitrogen (mg/dL								
Milk	12.2	19.6*	20.6*	24.2*	22.4*	0.873	0.137	0.429
Plasma	14.2	28.2*	26.2*	26.7*	25.3*	2.662	0.979	0.536
Microbial protein synthesis								

(Source:Almeida et.al.2018)

The allantoin concentration in milk and microbial protein synthesis for 45% and 50% of bagasse levels were similar to control diet. A linear decrease was observed for daily milk production, fatcorrected milk production, allantoin, and mi-crobial protein synthesis ($p<0.05$) with sugarcane bagasse diets increase. Neither the milk and plasma urea or microbial protein efficiency were altered by bagasse inclusion, while microbial CP synthesis decreased linearly with sugarcane bagasse increase in diets.

3.9. Effect of Milk yield and composition of cows according to different sugarcane bagasse levels.

Milk components can be altered with diet composition, since the substrates for mammary synthesis of milk components are provided by the fermentation in the rumen and by the digestion of the small intestine carbohydrates, affecting milk yield directly through the supply of glucose to the mammary gland and milk protein through the growth limitation of ruminal bacteria (Chalupa & Sniffen, 2000).

TABLE:9 Milk yield and composition of different bagasse level.

Item	Control	Sugarcane bagasse levels (%)				SEM(2)	Contrasts≥ (p-value)		Regression	R^2
		30	38	46	54		Linear	Quadratic		
	Milk yiel d (kg per day)									
Milk	19.7	22.4a	20.6	18.5a	16.4a	0.74	**	ns	$\hat{Y}$ = 29.9765 - 0.2507x	99.85
3.5% FCM(3)	19.9	22.7a	21.4	19.4	16.5a	1.03	**	ns	$\hat{Y}$ = 30.8634 - 0.2589x	97.17
	Mi lk compo sition (g per 100g)									
Fat	3.56	3.61	3.77	3.78	3.54	0.19	ns	ns	-	
Protein	3.19	3.25	3.19	3.11	3.11	0.07	*	ns	$\hat{Y}$ = 3.43 - 0.0063x	87.05
Lactose	4.71	4.82	4.77	4.71	4.66	0.04	**	ns	$\hat{Y}$ = 5.0176 - 0.0065x	99.71
Total solids	12.3	12.3	12.5	12.2	12.2	0.15	ns	ns	-	-

(Source:Chalupa & Sniffen, 2000)

Table 10. Bioeconomic system evaluation

Item[1]	Control	Sugarcane bagasse levels (%)			
		30	38	46	54
	Feeding costs				
Daily total diet offered (kg per cow)	5.63	5.63	5.48	4.95	4.28
Diet cost ($ kg^{-1})	0.22	0.27	0.26	0.24	0.23
Daily feeding cost ($ per cow)	4.10	4.94	4.56	3.90	3.17
	Gross revenue				
Daily milk yield (kg)	6.12	6.98	6.58	5.97	5.08
Milk price ($ kg^{-1})	0.46	0.46	0.46	0.46	0.46
Daily gross revenue ($ per cow)	9.18	10.48	9.88	8.95	7.62
Gross margin ($ per cow day^{-1})	5.09	5.53	5.31	5.06	4.44
Feeding cost per kg of milk produced ($)	0.21	0.22	0.21	0.20	0.19

(Source:Ferreira et.al,2010)

(Table 10) showed that the feeding cost per kg of milk produced was lower for high-level bagasse diet; however, considering the gross margin (R$ per cow per day), the greater value was obtained with lower bagasse inclusion. Therefore, the high inclusion of expensive concentrated feedstuff was offset by the high milk production

The control diet promoted the expected milk yield, as verified in other works with spineless cactus (Ferreira et al., 2010), and this result from an experiment with controlled diets corroborates the importance of the species for smallholder dairy system in semiarid regions.

Table 11: Suggested constraints to the utilization of cane tops in diets for cattle and the means of overcoming these.

Constraint	Solution
Low digestibility	Treat with alkali to increase digestibility.
Low fermentable nitrogen	Add urea at 2% Dry matter
Low bypass protein	Supplement with a bypass protein
Low dietary fat	source containing lipid (oil seed cake).
Low glucogenic potential from	Manipulate rumen (monensin) and
fermentation end products	Feed bypass starch (rice and maize grain).
Low dietary fat	Supplement with brans, polishings or oil seed meals.
Poor quality forage fibre	Supplement with green legume or young grass.
Low minerals	Add all minerals particularly Sulphar

CHAPTER 4

CONCLUSION

Important conclusions according to the objectives of this paper is

1.The main problem of sugarcane bagasse its low nutritional quality, low digestibility, low diatery fat, low protein and mineral.so it cannot fed more amount because its hampared digestion, growth rate and milk production.

2.Prospect of sugarcane bagasse its low cost ,availability .unique viable roughage. If concentration level of sugarcane bagasse is less it can increase digestibility, milk production and growth rate. So sugarcane bagasse is an important roughage for ruminants.

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