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Evaluation of Urea Treated Sugarcane Tops as Replacement for Panicum Grass Hay Fed for Afar Bulls Under Semi Intensive Management System

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Abstract

The experiment was conducted with the objectives to evaluate the comparative feeding value of sugar cane tops as replacement for *Panicum antidotale* grass hay, to see the nitrogen source enhancement of urea treated sugar cane tops with its economic benefits on feed intake, digestibility, body weight gain and carcass parameters of Afar bulls. Twelve male Afar bulls with the average age of 1-1.5 years old and initial mean body weight of 140.24±0.50 kg (mean±SD) were used for the experiment in randomized complete block design. The experimental animals were grouped in to three blocks of four animals based on their initial body weight and each animal within each block was randomly assigned to one of the three treatment diets. The experimental feeding treatments were (T1) grazing +100% panicum antidotal grass+Concentrate mix, (T2) grazing+100 % Urea treated sugar cane tops+Concentrate mix and (T3) grazing+50 % *Panicum antidotale* grass+50 % Urea treated SCT+Concentrate mix. The concentrate mix was at 3:2 (wheat bran and Noug seed cake) ratio. All the experimental bulls were supplemented with their respective feed rations at 2.5% of their body weight per day during the whole experimental period. The experiment was conducted for 150 days of feeding followed by carcass evaluation. The result of the chemical analysis of the feed in % of DM, CP and ADL showed a significant variation ($P<0.05$) between untreated and urea-treated sugarcane tops. Significant difference had observed ($P<0.05$) in final body weight and total body weight gain among the three treatments. Bulls fed on T3 showed a relatively higher final and average daily weight gain followed by T1 and T2 respectively. From the partial budget analysis it was observed that feeding on T3 to be more economical as compared to feeding on T1 and T2. From the present study, it can be concluded that, Afar bulls can be finished on grazing plus a ration of 50% *Panicum antidotale* grass+50 % urea treated SCTs+concentrate mix. Dressing percentage was numerically higher for bulls in T3 and T1 compared to bulls in T2. Thus, it could be concluded that, treatment T3 as feed supplementation for Afar bulls is very feasible both biologically and economically as compared to treatment 1 and treatment 2 respectively and it has a potential to improve the performance of Afar bulls under semi intensive management.

Keywords: Afar bulls; Carcass characteristics; *Panicum antidotale*; Sugar cane tops

Introduction

Ethiopia provides about 45% of all domestic meat consumption with small surplus which generates export income mainly from the sale of live animals. However, the earning from exporting of live animals and processed meat is very small as compared to the potential of the country (CSA, 2016/17). The average beef yield in Ethiopia per animal of 108.4 kg is by far less than 119 kg for the Sudan, 146 kg for Kenya, 127 kg for eastern Africa, 146 kg for Africa and 205 kg for the whole world [1].

Different feed options played a significant role to bring experimental animals to attain export market weight demand at different length of the fattening periods. It is well documented that for most animal production systems, feed and feeding constitutes 50% to 80% of the total cost of production; hence, any reduction in the cost of feeding could improve the economic efficiency of production [2]. Crop residues or by-products could be an important, low cost feed resource for animals in developing countries. These residues are characterized by low energy and protein contents and low digestibility which limits their utilization as feeds for animals.

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Sugar Cane Tops (SCT) are one of the main by-products of cane sugar industry representing 15 to 25% of the aerial part of sugar cane [3]. Sugarcane tops, and particularly the immature stalks, are highly palatable with good intake characteristics in livestock [3]. However, due to the low protein, minerals and energy contents, feeding sugar cane tops as sole diet for ruminants is limited [4]. The low nitrogen content of sugar cane tops could be increased by adding urea or a urea-molasses mixture during ensiling process [5].

Sugarcane top is a major by-product of the sugar industry which is often left in the field unutilized after harvest. The sugarcane top consists of 3 distinct parts: the green leaves (blades), the leaf sheath bundle and variable amount of immature cane. The yield of tops varies considerably with variety, age at harvest, growing condition and management practices [6-8].

The seasonal availability, low nutritive values on its own nature and loss through over drying are the main constraints limiting the use of sugarcane tops. Improving the values of sugarcane tops for ruminant feeding through silage and urea treatment is crucial for exploitation of available resources. Hence, Evaluation of different feed options on different breeds and age groups has played vital role in improving body weights and the country's foreign currency earning by exporting meat and live animals [9-11]. As the result of the expansion of sugarcane industry in Ethiopia, Tendaho sugar factory is one of the newly emerged sugar factories in Afar region. Thus, the available huge quantities of sugarcane tops in the area should be used as a source of feed for animals. Hence the study was designed to achieve the following objectives.

Objectives

To assess the comparative feeding value of sugar cane tops as replacement for Panicum grass hay.

To see the nitrogen source enhancement of urea treated SCT.

To identify the most economical feeding options for 1-1.5 years old Afar bulls to attain the targeted market weight.

Materials and Methods

Description of the experimental area

The Experiment was conducted at Dubti Pastoral and Agro Pastoral Research Center (DPARC), which is located at 12 km from Samara, the capital of the Afar National Regional State. The site is located between latitude 11°27' North; longitude 41°20' East and an altitude of 382 meter above sea level. The mean annual rainfall and temperature of the area is 400 mm and 34.1°C, respectively. Pastoral & agro-pastoral system of livestock production is the dominant agricultural activity in the region.

Urea-treatment of sugar cane tops

Urea treatment was conducted for experimental period using 100 litter water, 5 kg urea, 10 litter molasses and 100 kg air dried chopped SCT. The solution of urea, molasses and water was uniformly sprayed on the SCT after which the soaked SCT was rubbed and mixed by hand to properly incorporate the solution into the dried SCT. The treated SCTs were then covered by locally available materials to create a sealed condition. The treated SCT was stayed for 21 days for good flavored fermentation.

Management of animals

A total of twelve healthy Afar bulls with the average age of 1-1.5

years and initial mean body weight of 140.24±1.50 kg (mean±SD) were purchased from local markets in Asayta. Age of each animal was estimated using dental examination. The purchased experimental animals were kept in quarantine for about three weeks and treated for internal and external parasites by using Albendazole and acaridae, respectively. They were also vaccinated against anthrax using anthelmintic and acaridae and were individually penned based on their body weight and experimental diet.

Experimental design and treatments

A Randomized Complete Block Design (RCBD) was used for the experiment. At the end of the quarantine period, animals were blocked into three blocks of four animals each based on initial live weight, and animals within a block were randomly assigned to one of the three treatments. The experimental feed treatments were (T1) grazing+100% *Panicum antidotale* grass hay+Concentrate mix, (T2) grazing+100% Urea treated sugar cane tops+Concentrate mix and (T3) grazing+50% *Panicum antidotale*+50% Urea treated SCT+Concentrate mix. Treatments consisted of Urea treated Sugar Cane Tops (USCT) or Panicum Grass Hay (PGH) was supplemented with concentrate mixture (40% NSC: 60% WB). In addition to pasture grazing, all the experimental bulls were supplemented with treated dietary feeds with concentrate at 2.5% of their body weight throughout the fattening period. The daily amount of feed supplemented to the animals was adjusted every two weeks depending on the weight change of the bulls. In this experiment the supplemented feeds were offered twice a day at 8:00 h and 16:00 h in two equal portions. All animals had free access to water and mineral salt block. Three experimental animals from each treatment were slaughtered for carcass analysis. Each treatment groups were kept under their respective dietary rations for 150 days.

Feed intake

The amount of daily feed offers and refusals per head was recorded daily to determine daily feed intake. Grab samples from the three feed combinations were taken sometime in the middle of each week, and composite samples, one for each feed combination was formed for the entire feeding trial for chemical analysis. Feed refusals were sampled for each animal at seventh week of the feeding trial by taking daily grab samples and compositing the samples for each animal. Finally, refusal samples were pooled per treatment for chemical analysis.

Live weight gain

Live weight of the animals was measured every 14 days, after overnight fasting. Daily Body Weight (BW) gain was calculated as the difference between the final and initial BW divided by the number of feeding days.

$$ADG \text{ (kg/d)} = \frac{\text{Final body weight (Kg)} - \text{Initial live weight (Kg)}}{\text{No. of feeding days}}$$

Feed conversion efficiency is used to know how efficient the animals are converting the feed into meat. It was measured using the formula suggested by Gülten et al. (2000):

$$\text{Feed conversion efficiency} = \frac{\text{Average daily live weight gain (g)}}{\text{Average daily feed intake (g)}}$$

Carcass parameters

At the end of the experiment, three experimental bulls from each treatment were slaughtered after overnight fasting. Weights of edible and non-edible carcass component yields were determined. Empty

body weight and hot carcass weight of each animal were determined. The right half of the carcass was kept in deep freezer (-10°C) over night and de-boned in to lean meat, fat and bone components.

Dressing percentage was calculated as proportion of hot carcass weight to slaughter and empty body weights.

Dressing percentage based on $SW = (\text{Hot carcass weight (Kg)} / \text{Slaughter weight (Kg)}) \times 100$

The carcass was split in to 2 halves and the weight of each was taken. The area under the loin and rib eye muscle area was traced by tracing the cross sectional area of the 11th and 12th ribs after cutting perpendicular to the back bone with tracing paper, and the area was calculated using digital planimeter. The average of the right and left cross sectional areas was considered as a rib-eye muscle area.

Chemical analysis

Samples of feed offered and refusals were grounded to pass through 1 mm mesh screen size for determination of DM, Ash and CP content; according to AOAC (1990) [12]. NDF, ADF and ADL were analyzed using the procedures of Van Soest and Robertson (1985) [13]. Hemicellulose and cellulose were calculated from the differences between NDF and ADF and from the ADF and ADL, respectively.

Partial budget analysis

Partial budget analysis was determined to assess the profitability of the feeding experiment. The gross revenues of experimental bulls were estimated at the end of the fattening periods by help of three people who have enough knowledge on prices of fattened animals. Variable cost of partial budget was determined as a difference between the feed cost and selling price of bulls or feed cost divided by live weight gain. Net Income (NI) was calculated as the amount of money left when Total Variable Costs (TVC) are subtracted from Total Returns (TR):

$$NI = TR - TVC$$

The change in Net Income (ΔNI) was calculated as the difference between the change in Total Return (ΔTR) and the change in Total Variable Costs (ΔTVC):

$$\Delta NI = \Delta TR - \Delta TVC$$

The Marginal Rate of Return (MRR) has measured the increase in Net Income (ΔNI) associated with each additional unit of expenditure (ΔTVC) and expressed as;

$$MRR = (\Delta NI) / (\Delta TVC)$$

Statistical analysis

Data were analyzed using analysis of variance (ANOVA) following the general linear model procedure of SAS [14]. Treatment means were separated by Least Significant Difference (LSD) test. The model used for data analysis was; $Y_{ij} = \mu + T_i + B_j + e_{ij}$, where Y_{ij} = the response variable (the observation in j th block and i th treatment), μ = the overall mean, T_i = the treatment effect, B_j = the block effect and e_{ij} = the random error.

Results and Discussions

Chemical composition of the experimental feeds

The chemical composition of urea treated sugarcane tops, Panicum grasses (improved for ages) and concentrate feeds was used for the study. The result of the chemical analysis of the feed revealed that, the per cent DM, CP and ADL showed a significant variation

Table 1: Chemical composition of untreated and urea-treated sugarcane tops.

Chemical composition % DM basis	SCT	Feed offered		
		UTSCT	Over mean $\pm$ SE	Remarks
DM	34.75	31.39	33.27 $\pm$ 0.59	*
CP	3.98	6.91	5.45 $\pm$ 0.81	*
CF	33.62	32.15	32.23 $\pm$ 1.54	NS
NFE	61.15	59.44	60.24 $\pm$ 0.52	NS
NDF	74.32	68.43	71.38 $\pm$ 0.21	*
ADF	39.25	44.79	42.15 $\pm$ 1.24	*
Cellulose	32.11	36.15	34.61 $\pm$ 3.41	*
ADL	6.13	7.32	6.74 $\pm$ 1.29	*

SCT: Sugar Cane Tops; UTSCT: Urea Treated Sugar Cane Tops; DM: Dry Matter; CF: Crude Fiber; NFE: Neutral Free Extract NDF: Neutral Detergent Fiber; ADF: Acid Detergent Fiber; ADL: Acid Detergent Lignin; *: Significant level; NS: None Significant

Table 2: Chemical compositions of improved grasses and concentrate ingredients.

Chemical Composition	(Panicum. A)	NSC	WB	Concentrate mix
% Dry Matter	91	96.0	94.1	95.1
OM (% DM)	89.8	90.3	95.1	92.9
CP (% DM)	8.2	26.2	19.2	21.2
NDF (%DM)	60.2	38.9	41.0	39.3
ADF (%DM)	40.6	31.4	12.9	22.3
ADL (% DM)	5.2	14.3	3.5	8.9
DE (MJ/kg DM)	11.4	9.3	21.4	15.4

DM: Dry Matter; OM; Organic Matter; CP: Crude Protein; NDF: Neutral Detergent Fiber; ADF: Acid Detergent Fiber; ADL: Acid Detergent Lignin; NSC: Nuge Seed Cake, WB: Wheat Bran

Table 3: Daily dry matters and nutrients intake of Afar Bulls at different level of dietary feeds.

Parameters	T1	T2	T3	SEM	SL
Basal feed DM intake (g/d)	5459.1 ^a	5469.3 ^a	5477.2 ^a	42.8	ns
Supp. DM intake (g/d)	3426.21 ^a	3409.12 ^a	3436.11 ^b	18.69	*
Tot. DM intake (g/d)	8885.31 ^b	8878.42 ^b	8913.31 ^a	64.21	*
Tot. DM intake (% BW)	3.81 ^b	3.92 ^b	4.12.34 ^b	1.1	ns
Nutrient intake					
OM intake(g/d)	7941.32 ^{ca}	76417.5 ^b	8257.2 ^a	65.05	*
CP intake(g/d)	774.8 ^a	740.1 ^a	788.9 ^a	9.68	*
NDF intake(g/d)	4549.2 ^a	4564.9 ^b	4648.4 ^c	43.54	*
ADF intake(g/d)	2454.4 ^a	2519.6 ^a	2618.2 ^a	21.37	*

a,b,c means within the same row bearing different superscripts differ significantly ($p < 0.05$); SEM: Standard Error Mean; SL: Significant Level; DM: Dry Matter; OM: Organic Matter; CP: Crude Protein; NDF: Neutral Detergent Fiber; ADF: Acid Detergent Fiber; (T1) 100% Panicum A.+concentrate mix; (T2) 100% urea treated sugarcane tops+concentrate mix (T3), 50% Panicum A.+50% Urea treated SCTs+concentrate mixture.

($P < 0.05$) between untreated and urea-treated sugarcane tops (Table1). Higher CP (3.98% to 6.91%) and moderate ADL (6.13% to 7.32%) increment was observed in urea treated sugarcane tops. However, slight reduction was observed in DM, CF and NFE content after urea treatment. As the result revealed that, the DM showed the highest reduction (34.75% to 31.39%) while CF and NFE showed the lowest and moderate reduction (33.62% to 32.15%), (61.15% to 59.44%) respectively. As a result of urea treatment of sugarcane tops, a significant change in nutrient content was obtained; this result of feed improvement in the present study is in agreement with [15]

Table 4: Daily feed intake and daily weight gain of Afar bulls.

Fattening Period	T1		T2		T3	
	Feed intake (kg)	DWG (kg)	Feed intake (kg)		Feed intake (kg)	DWG (kg)
0-14 days	3.41	0.379	3.29	0-14 days	3.41	0.379
14-28 days	3.55	0.393	3.34	14-28 days	3.55	0.393
28-42 days	3.73	0.459	3.41	28-42 days	3.73	0.459
42-56 days	3.94	0.482	3.56	42-56 days	3.94	0.482
56-70 days	4.22	0.492	3.72	56-70 days	4.22	0.492
70-84 days	4.41	0.555	3.96	70-84 days	4.41	0.555
84-98 days	4.53	0.577	4.22	84-98 days	4.53	0.577
98-112 days	4.65	0.653	4.32	98-112 days	4.65	0.653
112-126 days	4.82	0.765	4.53	112-126 days	4.82	0.765
126-150 days	5.79	0.898	4.95	126-150 days	5.79	0.898

who stated that, improving feed quality through improvement in its protein content and digestibility results in improved body weight gain. The chemical analysis of the basal diets showed higher crude protein content for Panicum grass (8.2%) than treated sugar cane tops (6.9%) but lower than concentrate feed ingredients (Table 1 and 2). Higher crude protein content 26.2%, 21.2% and 19.2% for Noug seed cake followed by concentrate mixture and wheat bran, respectively. But Noug seed cake and wheat bran had lower neutral detergent fiber and acid detergent fiber than the basal diets (UTSCT and Panicum grass). The NDF and ADF constituent of wheat bran used in the present study were comparable to the values (41% and 12%) reported by [16] while the CP composition was slightly higher than the values (16.3%) reported by the same author.

Feed intakes and daily weight gain

Afar bulls fed on different levels of dietary feed are presented in Table 3 and 4. The present study indicated that, the amount of feed intake and daily weight gain of experimental bulls was increased up to the end of fattening period, while the rate of dietary feed intake and daily weight gain was apparently different across the three experiential groups of animals. Supplemented DM intake of bulls fed T3 was significantly higher ($p<0.05$) than T1 and T2, but there was no significant difference ($P>0.05$) in total dry matter intake across the three experimental groups of bulls. Daily nutrient intake was also affected by treatment groups. Accordingly, bulls in T2 had lowest ($p<0.05$) organic matter intake than in T3 and T1 respectively, while highest Crude Protein (CP), Neutral Detergent Fiber (NDF) and Acid Detergent Fiber (ADF) intake were recorded in bulls fed T3 followed by T1 and T2, respectively. Bulls supplemented with T3 had significant difference ($P<0.05$) compared to bulls supplemented with T1 and T2. This is attributed to the higher nutrients contained in T3 as shown in Table 3. The present average daily gain for bulls in T3 (0.741 kg) was higher than 0.614 kg/day reported for drought oxen fed teff straw and supplemented with wheat bran, wheat middling and cotton seedcake [17].

Live weight gain and feed conversion efficiency

The pattern of body weight change with mean initial, final live weight and average daily gain of the Afar bulls subjected to different level of supplementation feeds are presented in Table 5. As the present study result revealed, there was a significant difference ($P<0.05$) in final body weight and total body weight gain among the three treatments. Bulls fed T3 showed relatively higher final weight (251.41 kg) and average daily weight gain (0.741 g) followed by T1 (226.79

Table 5: Body weight gain of Afar Bulls fed on different dietary feeds.

BW parameters	Tx1	Tx2	Tx3	SEM
Body weight (kg)				
Initial(kg)	141.14 ^a	139.34 ^a	140.24 ^a	0.098
Final(kg)	226.79 ^c	207.26 ^b	251.41 ^a	0.012
Total body gain	85.65 ^c	67.92 ^b	111.17 ^a	0.016
ADG (g/kg)	0.571 ^a	0.452 ^b	0.741 ^c	0.012
FCR (g DMI/g ADG)	15.56 ^a	17.64 ^a	14.02 ^a	0.061

^{a,b,c}; means within the same row not bearing a common superscript differ significantly ($P<0.05$); ADG: Average Daily weight Gain; SEM: Standard Error Mean.

Table 6: Effect of dietary feeds on carcass components of Afar bulls.

Item	T1	T2	T3	SEM
Slaughter body weight (kg)	249.42 ^c	225.54 ^b	272.71 ^a	0.021
Hot carcass weight (Kg)	127.73 ^c	116.71 ^b	138.64 ^a	0.055
Dressing percentage	51.2 ^a	51.7 ^a	50.8 ^a	0.61

^{a,b,c}; means with different superscripts in the same row are significantly different ($P<0.05$) SEM: Standard Error Mean

kg) (0.571 kg) and T2 (207.26 kg) (0.452 g), respectively. This implies that the dietary treatments offered to all group of experimental bulls have variability in nutritional value and had played different roles to bring the animals to attain dissimilar marketable weights. The highest average daily weight gain recorded for Afar bulls in the present study was (0.741 g) in T3 (Table 5). This value was lower than 1.81 kg reported by [18] for Borana bulls fed on 40% maize silage, 20% cane molasses, 12% cracked maize, 25% sunflower, 2% bone meal and 1% salt. Similarly, it was lower than the finding of [19] who reported the daily weight gain of Fogera bulls fed with hay plus 6 kg of concentrate feed/day is (0.880 g). The reason for the difference might be the difference in breed and the dietary feed composition offered to the experimental bulls. The average value of DM conversion ratio of bulls obtained in the present study (15.74) (Table 5) was higher than values (13.93) obtained in supplementing different locally available energy source fed on local oxen in Wolaita [20]. The difference in feed conversion ratio might be attributed to difference in quantity and quality of the supplements and the physiological and genetic potential of the animals.

Dressing percent is an important measurement in meat animals; it indicates the amount of carcass in relation to the live weight of animals. It has been demonstrated that carcass traits including dressing percentage are influenced by several factors such as plane of

Table 7: Carcass parameter evaluation of Afar Bulls.

Carcass traits	Treatment		
	T1		T1
Chunk roll	14.81±1.2	Chunk roll	14.81±1.2
Rib Eye roll	4.60±0.40	Rib Eye roll	4.60±0.40
ChuckTender	0.60±0.20	Chuck Tender	0.60±0.20
Brisket	4.50±0.30	Brisket	4.50±0.30
Hump	1.69±0.21	Hump	1.69±0.21
Fore Shank	2.75±0.42	Fore Shank	2.75±0.42
Plate	3.90±0.35	Plate	3.90±0.35
Tender lion	1.12±0.10	Tender lion	1.12±0.10
Flank	0.42±0.23	Flank	0.42±0.23
Ball Tip	0.90±0.34	BallTip	0.90±0.34
Tri Tip	0.70±0.21	TriTip	0.70±0.21
Strip Loin	3.40±0.41	Strip Loin	3.40±0.41
Topside	4.73±0.45	Topside	4.73±0.45
Silver side	4.80±0.32	Silver side	4.80±0.32
Soft Shin	1.10±0.41	Soft Shin	1.10±0.41
Hard shin	1.11±0.44	Hard shin	1.11±0.44

nutrition, sex and age of the animals [21]. The dressing percentage in the present study was 50.8%, 51.7%, and 51.2% for T3, T2 and T1, respectively (Table 6). The present study showed that, there is no significance difference ($P>0.05$) in dressing percentage among the three treatment groups fed with difference type of dietary feeds. The mean dressing percentage recorded for Afar bulls in the present study was 51.2%. This value was lowest compared to other indigenous Ethiopian breeds such as Ogaden, Arsi, kereyu, Borana and Wolaita bulls where an average dressing percentage of 56%, 61%, 60.07%, 60.96%, 56.3% and 60.7% were reported by [9-11,20,22,23] respectively. Variation may occur as a result of differences in genotypes and age of experimental animals as well as the effect of experimental feed types. On the other hand, hot carcass weight of T3 (138.64 kg) was statistically higher as compared to the other two treatments. The present finding is in line with [10] who reported that, improved hot carcass yield (200 kg) harvested due to the effect of nutritional supplementation.

Carcass characteristics

Carcass characteristics and carcass components of Afar bulls exposed to different level of supplements are indicated in Table 7. Primal carcass cuts of Afar bulls in the present study showed significant difference ($P<0.05$) among the three treatments. Bulls fed with treatment T3 had higher chuck roll and topside than the other two groups of animals fed with T1 and T2, respectively. The difference might be due to the dietary treatments imposition, where bulls fed in T3 had received a better plane of energy feeds than bulls fed with treatment T1 and T2, respectively. Conversely no significant difference was observed to the other carcass parameters among the three treatment groups. The present result was in agreement with [11] who reported that there was no significant difference in dressing percentage, lean to fat ratio, fat to bone ratio and bone to lean ratio among the three dietary treatments effects on beef quality parameters of Kereyu bulls finished on Rhodes hay+20% molasses+40% wheat bran+40% Noug cake (T1), Rhodes grass hay+20% maize grain+45% wheat bran+35% Noug seed cake (T2) and Rhodes grass hay+65%

Table 8: Effects of dietary feeds on carcass and none characteristics of Afar bulls.

Variables	T1	T2	T3
Edible components (kg)			
Blood	7.65±0.74	7.17±0.76	7.97±0.76
Empty gut	15.61±0.23	14.39±0.41	15.89±0.51
Heart	1.49±0.91	1.43±0.89	1.52±0.89
Kidney	0.62±0.39	0.61 ±0.38	0.63±0.39
Liver with gall bladder	4.63±0.31	4.15±0.30	5.60±0.28
Abomasum	1.51±0.20	1.49±0.19	1.59±0.19
Omasum	1.61±0.20	1.59±0.19	1.57±0.19
Reticulo rumen	5.16±0.21	5.10±0.22	5.92±0.21
Esophagus	0.29±0.05	0.28±0.04	0.31±0.04
Diaphragm	0.92±0.07	0.95±0.06	0.96±0.07
Small intestine	2.96±0.13	2.94±0.12	3.10±0.13
Large intestine	2.75±0.17	2.67±0.16	2.97±0.16
Tail	0.81±0.09	0.80±0.07	0.97±0.06
None edible components (kg)			
Head	13.57±0.16	13.32±0.16	14.29±0.14
Skin	22.18±0.16	22.12±0.14	22.12±0.15
Lunges and trachea	2.18±0.31	2.10±0.32	2.35±0.32
Feet	4.85±0.13	4.81±0.15	4.94±0.14
Testicles	0.48±0.07	0.50±0.06	0.50±0.09
Pennies	0.68±0.08	0.67±0.07	0.60±0.07
Spleen	0.47±0.06	0.46±0.05	0.47±0.02
Internal Fat	2.67±0.82	2.15±0.91	2.97±0.81

wheat bran+35% (T3) cotton seed cakes for 168 days.

None carcass characteristics

None-carcass characteristics of Afar bulls exposed to different level of supplements are indicated in Table 8. Unlike carcass characteristics, different levels of dietary supplemental feeds did not bring considerable change ($P>0.05$) on edible and none-edible none-carcass components (Table 8). However, bulls fed T3 seem to have numerically higher edible and none-edible none-carcass components than the other treatments. Those slight differences might be attributed to the source of differences in that body weight gained during the experiment period. The present result in line with the same author who couldn't get significant difference on non-edible organs among the same dietary treatments finished on Kereyu bulls. Similarly, Yoseph et al., [22] could not find strong differences in some non-carcass parameters finished on different proportion of agro industrial by products and grass on tropical Ogden bulls.

Economic return on fattening of Afar bulls

The result of partial budget analysis of fattening of Afar bulls fed on three different dietary feeds for about 150 days to attain marketable weight is presented in Table 9. The economic analysis made to evaluate the three dietary feed treatments for fattening of Afar bulls showed that the gross margin per animal was higher for animals fed on treatment T3 followed by T1 and T2, respectively. Therefore, using treatment T3 as feed supplementation for Afar bulls is very feasible both biologically and economically as compare to treatment 1 and treatment 2 respectively. Hence, fattening of 1-1.5 years old Afar bulls

Table 9: Partial budget analysis of fattening of Afar bulls.

Items	T1	T2	T3
Number of bulls	4	4	4
Average purchase price of one bull	5250.00	5250.00	5250.00
Transportation cost per animal	210.00	210.00	210.00
Cost of concentrate feeds per animal	1223.34	1325.72	1136.40
Labor cost per animal	1087.50	587.50	887.50
Veterinary cost/animal	40.00	40.00	40.00
Total cost per animal	7810.84	7413.22	7523.90
Gross return per animal	9850	8650	10300
Gross margin per animal	2039.16	1236.78	2776.10

feeding T1 rations for 150 days is profitable for export market weight.

Conclusion and Recommendation

The experiment verified that supplementing of Afar bulls with a 50% *Panicum antidotale*+50% urea treated sugar cane tops+concentrate mixture at 2.5% of body weight to grazing based diet (i.e., T3) improved feed intake, average daily body weight gain, slaughter body weight and hot carcass weight compared to supplementation with sole 100 % *Panicum antidotale* grass+concentrate mixture+grazing (T1) and sole 100 % urea treated sugar cane tops+concentrate mixture+grazing (T2), respectively in descending order. Therefore, it could be suggest that supplementation of Afar bulls with T3 diet would be a better feeding approach to improve the performance of Afar bulls under semi intensive management system.

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