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On-farm Effect of Urea Treated Straw and Urea Molasses Block on Cross-Bred Dairy Cows at Lume District, Ethiopia

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Abstract

On-farm study was conducted to evaluate the effects of urea treated straw and urea molasses block on milk yield, milk composition, feed intake and body weight gain of cross-bred lactating dairy cows in urban and peri-urban dairy production system of Lume District. Three treatments were considered:

a. T1: urea treated straw + concentrate

b. T2: urea molasses block + untreated teff straw + concentrate

c. T3: untreated straw + concentrate. Pre-visit was made and 40 cross-bred dairy cows with 2nd and 3rd parities were selected and assigned to treatments. Highly significant differences were observed. Least square mean of total DM intake was 10.58 ± 0.09, 10.18 ± 0.08 and 10.1 ± 0.1 for T2, T1and T3 respectively. Daily weight gain was higher in T1 (0.28 ± 0.03 kg) and followed by T2 (0.16 ± 0.04 kg per day) and T3 (0.02 ± 0.04 kg per day). The daily milk yield was high in T2 (10.06±0.10 L per day) and followed by T1 (9.61±0.11L per day) and T3 (8.701±0.09L per day). In conclusion urea molasses block (T2) has showed increased daily DM intake and daily milk yield. Therefore, use of urea molasses block for dairy animals will be effective in urban and peri urban area where milk market access is available. Therefore, the smallholder farmers and commercial milk producers advised to use UMB to improve milk production of cross-bred dairy cows.

Keywords: Milk yield; Teff straw; Urea molasses block; Urea treated straw; Weight gain

Abbreviations: UMB: Urea Molasses Block; NDF: Neutral Detergent Fiber; ADF: Acid Detergent Fiber; GLM: General Linear Model; DMRT: Duncan's Multiple Range Test; SNF: Solids-Not-Fat

Introduction

The total cattle population in Ethiopia is estimated to be about 57.83 million. Out of this, the female cattle constitute about 55.38 percent [1]. Dairy cattle produce milk which serves as nourishment for new born calves and as food for infants and also for adult humans [2]. However, dairy productivity is very low [2], due to shortage feed both in terms of quantity and quality that hindering the development of dairy industry in Ethiopia. Dairy animals suffer most by the feed shortage and their peak lactation is largely affected.

On the other hand, residues of cereals and pulses account for about 31.29percent of the total animal feed utilized and ranked second to grazing (55.33%) in Ethiopia [1]. However, their potential is limited due to their high fiber, low protein, mineral and vitamin content. Increasing efficiency of available feed resource such as crop residue treatment and nutrient supplementation are one of the appropriate methods that improve milk production [3,4]. The cost-benefit analysis and feasibility of using ammoniated straw and urea molasses block as animal feed in Ethiopia was reported by [3] & [4] respectively for crossbred lactating dairy cows.

Lume district has a considerable potential and opportunities for development of improved smallholder dairy production and is market-oriented. However, there is limited information on the use of urea treated straw and urea molasses block as comparative alternative strategy to improve the nutritive value of low quality roughages and to increase milk production of dairy cows in the area. Therefore, this study was designed to evaluate the on farm effects of urea treated teff straw and urea molasses blockon cross-bred dairy animals at Lume District, East Shewa Zone.

Materials and Methods

Area Description and farmers selection

The study was conducted in Lume district (urban and peri-urban areas), East Shewa Zone. The district 70km away from Addis Ababain south direction. The districts altitude ranges from

1500 to 2300 meters above sea level. Farm observation was done and farmers keeping cross-bred lactating cow were selected purposively and trained on general management of dairy cows including urea molasses block and urea treated straw preparation and feeding. Discussion with local development agents was held on intervention approaches and systematic coaching

Experimental animals and treatments

Forty lactating cross-bred dairy cows at early to mid-lactation (about 5-8 weeks after calving) were selected purposively for the on-farm feeding trial based on farmers willingness to undertake the experiment and commitment for data collection, and monitoring of feed intake and milking. Average body weight of the selected cows was ranging from 287 to 377kg with an average initial milk yield ranging from 5 to 11kg/cow/day. The selected cows were in second and third parity and treated for internal and external parasites. Three treatment groups were considered (Table 1).

Table 1: Treatment arrangement.

Treatments	Feed Supplement	Number of Lactating Cows
T1	UTS + concentrate	15
T2	UMB + UTTS + concentrate	15
T3 (control)	UTTS + concentrate	10

Note: UTS= urea treated teff straw; UMB = urea molasses block; and UTTS = untreated teff straw

Dairy cows were assigned and fed for a period of 45 days to collect feeding response data and with an adaptation period of 15 days. All cows have free access to water. The initial and final body weights of the experimental cows were estimated using heart girth measurements.

Experimental feed preparation and laboratory analysis

5.3.1.Urea treated teff straw: The straw was treated with a urea solution prepared from 4% of urea, 10% of molasses and 100 liters water per 100kg of air-dried straw and, incubated in pit. The wall of the pit was covered with polyethylene sheet. The straw was treated, trampled and compacted batch by batch until filled to the pit capacity. Finally, the pit was sealed with plastic sheet and loaded on top by mass of soil to make it airtight. It was, then, left unopened for twenty-one days. By the end of incubation period, the pit was opened and a portion of the straw was taken daily and ventilated overnight to remove residual ammonia before offering to the animals.

A concentrate mix that has been assumed to be sufficient for the entire experimental period was formulated based on milk yield (0.5kg per 1 liter of milk yield per day) [5]. A concentrate was mixed from 25% maize, 44.6% wheat bran, 5.8% nougseed cake, 14.4% soyabean, 2.6% nora (mineral source specially, calcium carbonate), 0.7% salt and 6.9% molasses.

5.3.2.Urea molasses block: UMB was formulated from 10% noug seed cake, 25% wheat bran, 10% cement, 40% molasses, 10% urea and 5% common salt. Additionally, 4% of water (of total weight) was mixed to make a block weighing 5kg. The mixture finally had a dough texture and was put into a plastic sheet lined, oval can for molding. Compaction was applied using a wooden bar; afterwards the block was left for 15 minutes until it maintained a proper shape. Finally, it was removed from the can and left to dry in a well ventilated room for about 72 hours, after which it was ready for feeding.

All samples of feed offered were analyzed for DM, ash, neutral detergent fiber (NDF) and acid detergent fiber (ADF) as per the methods of Van Soest and Robertson. Hemicellulose was calculated from the difference between NDF and ADF.

For milk yield analysis a daily milk record (morning and afternoon separately) was taken by individual farmers themselves and enumerator. All the cows were hand milked twice a day (7:00 AM in the morning and 4:00 PM in the afternoon) and milk yield measurements were taken by using graduated cylinder every day throughout the study period. The milk samples were taken to determine chemical composition of milk (fat, protein, total solid, solid not fat and milk density).

Statistical analysis

The collected data were analyzed with General Linear Model (GLM) procedure of SAS (2004) for least square analysis of variance. Mean comparisons were done using Duncan's Multiple Range Test (DMRT) for variables whose F-values declared a significant difference. Differences were considered statistically significant at 0.01% significance level.

Result and Discussion

Chemical composition of experimental feed

The percent feed chemical composition varied depending on feed type, in which the contents of CP, was higher in urea molasses block and concentrate mix (Table 2). Urea-treatment increased CP content of the teff straw more than double from 3.2 to 7.83% and decrease NDF from 41.85 to 37.13% denoting the breakage of lignified bond and release of hemicellulose. Similar changes were observed in CP and NDF of wheat straw following urea treatment [6]. But, the CP content of treated straw observed in this study was lower than that of previous report of Rehrahie [3].

Table 2: Chemical composition of experimental feeds.

Composition%	UTTS	UTS	UMB	Conc.
DM	87.78	71.5	94.44	94
CP	3.2	7.83	23.94	23.2
Ash	8.1	6.5	22.77	5.71
NDF	68.53	61.6	12.5	37.7
ADF	41.85	37.13	4.1	9.63
ADL	8.88	10.8	0.9	2.67

DM= Dry matter; CP= Crude protein; ADF= Acid Detergent fiber; ADL= Acid detergent lignin; NDF= Neutral detergent fiber; UTTS= Untreated teff straw; UTS= Urea treated teff straw; UMK= Urea molasses block and Conc. = concentrates

The effectiveness of urea treatment has been reported to be dependent on many factors among which the poorer the quality of the roughage the better is the response to urea treatment [7].

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In the present study, at environmental temperature of mean minimum 13 °C and maximum 25 °C, treated teff straw had pH value of 9 and appeared dark yellowish in color having soft consistency with modest ammonia smell ensuring the effectiveness of the treatment.

Daily nutrient intake of the experimental animals

Significant differences (P<0.01) were observed between treatments in daily nutrients intake. The total DM intake was improved in T2 as a result of UMB feeding as supplementary feed. Similar result was also reported in Fogera district where, supplementation of UMB increases DMI of cross-bred dairy cows [4].

Feeding urea treated teff straw was found to improve straw DM intake (10.18±0.08), compared to untreated teff straw (10.1±0.1kg per day). This result is in agreement with the finding of Teshome [8] who reported an increased DMI of cross-bred dairy cows fed urea treated wheat straw in Fogera district (Table 3).

Table 3: Total daily nutrient intake of the experimental animals.

Nutrition	T1	T2	T3	Mean	CV	P-Value
TDMI (kg)	10.18±0.08b	10.58±0.09a	10.1±0.1c	10.46	19.03	***
TCPI (g)	530±3a	350±33b	270±3c	407	17.01	***
TNDFI (kg)	5.50±0.04a	5.16±0.04a	5.11±4b	5.35	17.39	**
TADFI (kg)	2.51±20c	2.7±20a	2.74±2a	2.67	16.56	***
TADLI (g)	610±4a	480±4b	550±5c	540	17.55	***

Note: abc Different superscripts indicate significant (P < 0.01) differences between means in the same row; TDMI kg/day= Total Dry Matter intake per day in kilogram; TCPI g/day= total crude protein intake in gram per day; TADFI kg/day= Total acid detergent fiber intake in kilogram per day; TNDLI g/day= Total neutral detergent lignin intake in gram per day; TNDFI kg/day= Total neutral detergent fiber intake in kilo gram per day; T1; Treatment one; T2= Treatment two; T3= Treatment three CV= Coefficient variation.

Body weight gain

Significantly higher (P<0.01) daily weight gain was recorded in T1 compared to T2 and T3. T2 had higher daily weight gain compared to T3 (Table 4). In contrast, weight loss in lactating cross-bred dairy cows fed on treated rice straw was reported in Fogera District [8]. However, Takeba [4] reported that, the estimated daily body weight gain of cross-bred dairy cow supplemented with urea molasses block in Fogera district was 236g while others non-supplemented cross-bred lactating cows 120g per day (Table 4).

Table 4: Least square mean body weight change of experimental cow.

Treatment	IW1	FW2	DWG
T1	376.83±15.01a	389.28±14.83a	0.28±0.03a
T2	287.46±19.90b	294.59 19.65b	0.16 0.04b
T3	286.2±18.99b	287.1±18.75b	0.02±0.04c
Grand Mean	316.3	323.7	0.19
P-Value	***	***	***
CV	15.71	15.12	61.65

Note: abc Different superscripts indicate significant (P < 0.01) differences between means in the same column; T1 = Treatment one; T2 = Treatment two; T3 = Treatment three; IW1= Initial weight; FW2 = Final weight; DWG= Daily weight gain and CV =Coefficient variation

Daily milk yield and composition

The main purpose of dairying in urban and peri-urban area of Lume district was to produce milk for marketing and family use. The area has market oriented dairy farms and hence the farmers kept cross-bred dairy cows and give priority for raw milk sale to cooperatives or to private milk traders.

There was significant difference (P<0.01) where the cows supplemented with UMB recorded higher daily milk yield (Table 5). Morning and evening milk yield was high in T2 (6.44±0.06 and 3.63±0.04); and followed by T1 (6.22±0.06 and 3.61±0.05) and T3 (5.46 ±0.07 and 3.24±0.04), respectively. Daily milk yield were 10.06±0.10, 9.61±0.09 and 8.70±0.11 in T2, T1 and T3 respectively. This finding is in agreement with Takeba [4] who reported that the saleable milk off-take of cows received the UMB supplementation was significantly increased by 34 % for crossbred dairy cows in Fogera District of Amahara region. But the result obtained in this study is much higher than that of Nkya et al. [9], who reported the average daily milk yield of crossbred dairy cows managed with cut and carry + UMB supplementation as 7kg per day at peri-urban areas of Tanzania. However, some finding shows higher milk yield than the milk yield obtained in this study. For instance, Seyoum & Fekede [10] reported the average daily milk yield of cross-bred dairy cows managed under cut and carry + UMB as 10.62kg per day at Holetta Agricultural Research Center (Table 5).

Table 5: Least Square Mean of Daily Milk Yield and Composition.

Variables	T1	T2	T3	Mean	CV	P-Value
M Milk	6.22±0.06b	6.44±0.06a	5.46±0.07c	6.03	22.42	***
E Milk	3.61±0.05b	3.63±0.04a	3.24±0.04c	3.01	26.67	***
T Milk	9.61±0.09b	10.06±0.10a	8.70±0.11c	9.45	22.17	***
Protein%	3.41±0.25a	3.45±0.29a	3.23±0.32ab	3.37	29.07	***

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Fat%	3.21±0.08a	3.32±0.09a	3.16±0.10a	3.22	9.39	NS
SNF%	7.39±0.20a	7.50±0.23a	7.12±0.26a	7.32	10.67	NS
DG ml	1.027±0.001a	1.025±0.001a	1.026±0.001a	1.026	0.27	NS
T S%	10.99±0.44a	11.04±0.49a	11.48±0.55a	11.19	15.1	NS

Note: abc Different superscripts indicate significant (P < 0.01) differences between means in the same row; MMILK= morning milk yield; E Milk= Evening milk yield; TMilk= Total milk yield; Protein= Protein; Fat= fat; M SNF= Solid not fat; DG ml=Density gram per milliliter; TS = Total solid; T1 = Treatment one; T2 = Treatment two; T3 = Treatment three and CV =Coefficient variation

The overall least square mean of protein, fat, total solids, density and solids-not-fat (SNF) contents were not significantly different in the study area. But, Takeba [4] reported that, UMB supplementation significantly increased the milk fat content by 7 % in cross-bred dairy cows. However, Rehrahie [5] reported that only milk protein was significantly different while milk fat and total solid were not significantly different treated and untreated wheat straw. In addition, Rehrahie & Ledin [11] reported that the effect of hay-based diet, urea treated teff straw based diet and urea treated barley straw-based diet on milk fat percent didn't differed significantly.

Partial budget analysis of urea molasses block and urea treated teff straw

Based on average milk price paid to producers by milk cooperatives and private consumers, with 10.50 Birr/1t milk, cows fed UMB based diet have got the highest net return 83.27ETB /cow/day. This was followed by urea treated teff straw supplemented diet and control. Relatively, the better economic return of crossbred cows fed urea treated straw was reported by Rehrahie [5]. Takeba [4] also reported that, UMB supplementation seems to be economically meaningful for crossbred dairy cows only (Table 6).

Table 6: Partial budget analysis for lactating crossbred cows fed UMB and UTS.

Types of Feed Treatment	Cost of Milk Production	Average Milk Yield / cow/day/(lit)	Milk Price/lt ETB	Gross Return/cow/ day ETB	Net Benefit /cow/ day ETB
T1	24.69	9.61	10.5	100.91	76.22
T2	28.24	10.06	10.5	105.63	77.39
T3	23.1	8.7	10.5	91.35	68.25

T1= Treatment one; T2= Treatment two; T3= Treatment three and ETB= Ethiopia birr

Conclusion and Recommendation

The improvement in feed and nutrient intake and the concomitant increase in the daily milk yield have different economic implications for the farmers in different livestock production systems. For instance, the greater improvement in daily milk yield of crossbred dairy cows in market oriented, peri-urban livestock production systems, where milk marketing is very attractive, will result in a significant economic advantage as compared to rural production systems, where milk has to be frequently converted into butter because of lacking market access. Therefore, use of urea molasses block for dairy animals will be effective in urban and peri urban area where milk market access is available.

In this study urea molasses block raise DM intake of roughages and milk yield where its production procedure is very easy and simple, can be produced from locally available materials and requires less labor. Therefore, commercial and smallholder dairy farmers can improve milk production as well as body weight of the milking cows through supplementation of UMB.

References

1. CSA (Central Statistics Authority) (2016) Central Statistics Authority of the Federal Democratic Republic of Ethiopia. Agricultural Sample Survey 2015/2016 (2008E.C). Vol. II. Report on livestock and Livestock Characteristics. Statistical bulletin. 583: 33-34.
2. Guo Tingshuang, Manuel D. Sánchez, Guo Pei Yu (2002) Animal Production Based on Crop Residues; China's Experiences. FAO (Food and Agriculture Organization of the United Nations), Rome, Italy.
3. Rehrahie Mesfin (2001) Biological and Economical Evaluation of Urea Treated Teff and Barley Straw Based Diets to Crossbred Dairy Cows in the Highlands of Ethiopia. Swedish University. Uppsala, Sweden. Msc Thesis. pp. 1-12.
4. Tekeba Eshetie, Wurzinger M, Baldinger L, Zollitsch WJ (2012) Effects of dietary supplementation with Urea Molasses Multi-Nutrient Block in local Ethiopian and crossbred dairy cows. Livestock Research for Rural Development 25(6).
5. Rehrahie Mesfin, GetuKitaw (2010) Effect of feeding urea treated wheat straw based diet on biological performances and economic benefits of lactating Boran-Friesian crossbred dairy cows. Livestock Research for Rural Development 22(12).
6. Getahun Kebede (2006) Effect of urea treatment and leucaena (leucaenaleucocephala) supplementation on the utilization of wheat straw by sheep. M Sc Thesis, Alemaya University, Ethiopia.
7. Sundsttol F, Coxworth M, Owen E (1984) Ammonia Treatment. In: Sundstol F, Owen E (Eds.), Straw and other fibrous by products as feed. Elsevier press: Amsterdam. pp. 199-206.
8. Teshome Derso (2009) On-farm Evaluation of Urea Treated Rice Straw and Rice Bran Supplementation on Feed Intake, Milk Yield and Composition of Fogera Cows, North Western Ethiopia. MSc. Thesis, (Animal Production), Ethiopia.
9. Nkya R, Kessy BM, Shem MN, Mwanga IE (2002) Enhancing the performance of cut-and-carry based dairy production in selected peri-urban areas of Tanzania through strategic feed supplementation, pp. 77-86.

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10. Seyoum Bediye, Fekede Feyisa (2006) The status of Animal feeds and nutrition in thewest shewa zone of Oromiya, Ethiopia. Addis Ababa, Ethiopia, pp. 27-49.

11. Rehrahie Mesifen, Ledin I (2004) Assessment of the Treatment and the Use of Urea Treated Straw for Cattle Feeding in Selale, Central Ethiopia. Ethiopian Journal of Animal Production 4(1): 23-32.

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