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Full Length Research Paper

Effect of maize stover treated with urea on feed intake, milk yield and composition of crossbred dairy cows

***Tesfaye Mediksa, Habtamu Abera and Dereje Bekele**

Bako Agricultural Research Center, West Shoa, Bako, Ethiopia

*Corresponding author email: tesfishmidoo2008@gmail.com

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ABSTRACT

The experiment was carried out at Bako Agricultural Research Center to evaluate the feeding value of maize stover treated with urea when offered as basal diet on feed intake, milk yield and composition of lactating crossbred dairy cows. Eight lactating crossbred dairy cows similar milk yield, same stage of lactation and parity were used in a switch over 4X4 double Latin square design. Experimental treatments were: Maize stover without treated with urea + grazing (T1), Maize stover without treated with urea install feeding (T2), Maize stover treated with urea install feeding (T3) and Maize stover treated with urea + grazing (T4). Animal in four experimental treatments were supplement with 0.5 kg concentrate mixture per litre of milk yield. Results of chemical analysis study of experimental feeds indicated that maize stover treated with urea (CP=9.97%, ME=9.21 $MJKg^{-1}$DM) had better nutritive value than untreated maize stover (CP=5.78% and ME=5.83 $MJKg^{-1}$ DM). The daily DM, CP, and OM intake were significant ($P<0.05$) among the treatments with the highest intake observed when cows were fed urea treated maize stover (T3). Daily milk yield was higher ($P<0.05$) for T3 (7.86) as compared to T1 (5.34 l/d). Therefore, the result demonstrated that urea treated maize stover had better feeding value as compared to untreated maize stover for lactating crossbred dairy cows, especially, in the dry season when conventional roughages with low in CP content are in short supply.

Keywords: Basal diet, Dairy cows, Crossbred, Feed intake, Maize stover and Urea

INTRODUCTION

In developing countries, livestock sector is highly dynamic to meet rapidly increasing demand for livestock products. This demand is largely driven by human population growth, income growth, urbanization and the production response in different livestock systems. The main constraint facing small scale dairy farmers in smallholder mixed farming, pastoral and agro pastoral production systems across East Africa is the inability to provide sufficient quantity and quality feeds to their livestock on a consistent basis (Hall *et al*., 2008). Low quality roughages including straws, stovers, husks and other crop by-products make up a major portion of animal feed in many developing countries (Ali *et al*., 2012). The major feed resources in Ethiopia for ruminants are natural pasture and crop residues, which are categorized as poor quality roughage with low intake (Berhanu *et al.,* 2009).

Maize stover consists of the leaves, husks, stalks and cobs of maize plants left in a field after harvest of cereal grain. Maize stover is a very common agricultural product in areas having large acreage under maize cultivation. Maize stover is utilized for animal feeding during the scarcity of green fodder called lean periods. Therefore, it is apparent that the nutritional quality of maize stover is poor and to maintain the health and to increase the milk production potential of milk animals, maize stover should be fed along with the concentrate (Gusha *et al.,* 2014). The nutritional quality of urea treated maize stover is drastically enhanced compared to normal stover (Gusha *et al.,* 2014). The increased microbial biomass in the treated stover may contribute significantly towards higher crude protein content (Mahesh and Mohini, 2013).Thus efforts were directed to increase the contents of protein in maize stover silage by incorporating non-protein nitrogenous compounds (Ali *et al*., 2012). The objective of this study was to evaluate the feeding value of urea treated maize stover when offered as basal diet on feed intake, milk yield and composition of lactating crossbred dairy cows.

MATERIALS AND METHOD

Study location

The experiment was carried out at Bako Agricultural Research Center, Ethiopia, longitude 37° 09' E, latitude 09° 06' N and an altitude 1650 m above sea level. The center is located 260 km west of the capital city, Addis Abeba.

Experimental animals

Experimental cows with similar lactation performance, same stage of lactation, body weight, and parity were selected from the total dairy herd available in Bako Agricultural Research Center. All experimental cows were weighed and dewormed before starting the experiment.

Process of ensiling

The maize stovers were chopped into the size of 2-3 cm prior to ensiling process. In 100 litres of water 5 kg of urea was dissolved and sprinkled uniformly over the 100 kg of chaffed maize stovers by using sprinkler and buckets. The treated maize stovers were mixed by using a fork. All mixtures were firmly packed by trampling to remove air and the silo was sealed. The treated maize stover was ensiled for 30 days. Then used for conducting the experiment with lactating crossbred dairy cattle. The basal and concentrate feed offer was adjusted according to stated in (Mediksa T., 2017).

Experimental design

Eight lactating crossbred cows were randomly assigned in a double switch over 4X4 Latin square design. There were four periods each consisting 30 days. During the first 15 days of each period, animals were acclimated to the experimental diet and the remaining 15 days were used to collect data. Hence, the experiment took 120 days; being started in December 2015 and completed in March 2016. The concentrate mixture is composed of (49.5% maize grain + 49.5% noug seed cake + 1% salt).

Experimental treatments were

T1: Maize stover without treated with urea + grazing
T2: Maize stover without treated with urea install feeding
T3: Maize stover treated with urea install feeding
T4: Maize stover treated with urea + grazing
Animal in four experimental treatments were supplement with 0.5 kg concentrate mixture per litre of milk yield

Measurements

The daily milk yield data of individual cows was taken using a Salter balance. About 100 ml milk sample in the morning and afternoon was taken twice every week during the experiment from each cow into a glass measuring cylinder (100ml capacity) after the milk was thoroughly and gently mixed. Body weight was recorded for two consecutive days at the beginning and end of each experiment period for each treatment to monitor body weight change that may occur as a result of dietary treatments. Metabolisable energy contents of the feeds were determined according to the common procedures stated by Mediksa *et al*. (2017). The chemical analysis of feed offered, feed refused and milk compostion were determined according to the common procedures stated by Mediksa *et al*. (2016).

Statistical analysis

The data were analyzed by the GLM option in the ANOVA program of the SAS (2002) software. Sources of variation were animals used, period effect, different feed used and error.

RESULTS AND DISCUSSION

Chemical composition of experimental feeds

The maize stover is supposed to be inferior source of nutrients. Hence in order to improve the CP content, it was treated with urea through the process of ensiling. The chemical composition of maize stovers and concentrate mixture are presented in the table (1). Data

Table 1. Chemical composition of experimental feeds offered to lactating crossbred dairy cattle

Feeds offered	DM (%)	Chemical compositions (and %DM)					IVOMD (%)	ME (MJ Kg^{-1} DM)
	DM	CP	OM	NDF	ADF	ADL		
Treated Maize Stover	92.07	9.97	94.14	81.96	66.33	15.73	57.76	9.21
Untreated Maize Stover	92.94	5.78	95.00	86.35	56.85	10.79	36.44	5.83
Concentrate	92.18	33.33	94.28	33.75	9.06	2.89	78.75	12.6

Table 2. Chemical compositions of experimental treatment of lactating crossbred dairy cows.

Chemical compositions	Experimental treatments				LSD	SL
	Treatment 1	Treatment 2	Treatment 3	Treatment 4		
Total DMI	1.2282[c]	4.5306[b]	6.2220[a]	1.9169[c]	1.1742	*
DMI	1.1415[c]	4.2107[b]	5.7286[a]	1.7649[c]	1.0829	*
CPI	0.06598 [c]	0.24338 [b]	0.57114 [a]	0.17596 [c]	0.1008	*
OMI	1.0844 [c]	4.0002 [b]	5.3929 [a]	1.6614 [c]	1.0212	*
NDFI	0.9857 [c]	3.6360 [b]	4.6952 [a]	1.4465 [c]	0.8963	*
ADFI	0.12316 [c]	0.45434 [b]	0.90111 [a]	0.27761 [c]	0.1616	*

LSD= least significance difference; SL= significance level, ADF= acid detergent fiber; CP= crude protein; DM= dry matter; NDF= neutral detergent fiber; OM= organic matter.

Table 3. Effect of treated of maize stover on milk yield and composition of lactating crossbred dairy cows.

Milk yield and compositions	Experimental treatments				LSD	SL
	Treatment 1	Treatment 2	Treatment 3	Treatment 4		
Milk yield, kg/day	5.3391[c]	6.2587[bc]	7.8547[a]	6.7406[ab]	1.2401	*
Milk fat %	4.83	5.36	5.01	5.05	0.6194	ns
Milk protein %	3.47	3.56	3.48	3.46	0.1079	ns
Solid not fat %	8.31	8.54	8.32	8.29	0.2883	ns
Total solids %	13.27	13.90	13.33	13.34	0.6700	ns

LSD= least significance difference; SL= significance level, ns = not significant.

showed that there was significant improvement in crude protein content in urea treated maize stover which may be due to impregnation of nitrogen on the particle of stovers.

Feed intake

The mean daily DM, CP, OM, NDF and ADF intake of lactating crossbred dairy cows fed urea treated and untreated maize stover and supplemented with concentrate mix are presented in Table 2. The daily DM, CP, OM, NDF and ADF intake were significant ($P<0.05$) among treatments. The highest daily dry matter intake was observed when cows were fed with treated maize stover at install feeding (T3) as a basal diet. The difference could be attributed to the high rumen degradable protein content of the treated maize stover at install feeding compared to untreated one, which might have enhanced the efficiency of rumen microorganisms that increase fiber degradability and digestibility thereby improving feed intake (McDonald *et al.,* 2002). The low CP and high fiber contents of the untreated stover likely depressed both feed intake and digestibility since NDF is negatively correlated with feed intake and its content above 55% can limit DM intake (Arelovich *et al.,* 2008).

Intake of feed by ruminant can be improved through concentrate supplementation (Gatenby, 2002). Protein meal supplements stimulate intake of low quality roughage diets by providing rumen degradable protein that are deficient in the roughage (Shreck *et al.*, 2011; Mahesh and Mohini, 2013). Earlier report of Mulu (2005) showed improvement in the daily total DM intake is due to supplementation. This may be attributed to the ability of the supplements to provide nitrogen and energy for the cellulolytic microbes upon degradation in the rumen (Wambui *et al.*, 2006).

Milk yield and composition

The results of mean daily milk yield and composition of crossbred dairy cows fed treated and untreated maize stover are shown in Table (3). Cows fed urea treated

Table 4. Effect of treated maize stover on mean live weight change of lactating crossbred dairy cows.

Body weight changes	Experimental treatments					
	Treatment 1	Treatment 2	Treatment 3	Treatment 4	LSD	SL
	-188.9	-14.7	+147.2	+38.9	422.9	ns

LSD= least significance difference; SL= significance level, ns = not significant.

maize Stover on install feeding with supplementation (T3) produced more milk than other treatments. The difference in milk yield among treatment groups is attributed to the differences in crude protein and energy contents in the diets (Steinshamn, 2010); Getu (2006) indicated that lactating crossbred dairy cows fed urea treated wheat straw basal diet produced significantly higher milk yield when supplemented with 50% vetch (*Vicia dasycarpa*) diet than the non-supplemented ones because of better nutrient supply. Milk protein, milk fat, solid not fat and total solid contents were non significant (P>0.05) among dietary treatments. These findings are similar to work done by Gusha *et al.* (2014) where urea and protein supplementation did not alter milk composition.

Daily body weight change

The daily mean live weight and periodic weight changes of crossbred dairy cows fed treated and untreated maize stover are shown in Table (4). The result of mean daily live weight loss was non significant (P>0.05) among the dietary treatments. The presence of marked differences in nutrient intake among the dietary treatments did not bring a significant effect in weight change of the cows, which may be due to the utilization of additional nutrients consumed for milk production than weight gain.

Similar amount of body weight loss of 120 g/day with the present study was reported for lactating crossbred cows by Getu (2006). Cows loss body weight after the first period of the lactation cycle, but with a declining trend. However, improvements in body weight condition of cows have also been observed for all dietary treatments during the last period of the experiment. This could probably be associated with more diversion of the available nutrients to body tissue accretion and the decreased milk yield during this period.

CONCLUSION

It can be concluded that cows fed basal diet of urea treated maize stover on install feeding with recommended concentrate mix can optimize biological benefits.

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