BRJ BASIC RESEARCH JOURNALS

Basic Research Journal of Agricultural Science and Review ISSN 2315-6880 Vol. 6(7) pp. 73-78 October 2018
Available online http//www.basicresearchjournals.org

Full Length Research Paper

Pre-extension demonstration of napier grass (*Pennisetum purpureum*) silage on lactating crossbred dairy cows in Guto Gida District of West Oromia

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Acceptance 03 November, 2018

ABSTRACT

A study was conducted at East Wollega zone of Guto Gida district to create awareness on the importance of the napier grass silage among the rural farmers and to enhance the farmers' knowledge and skill on the technology usage. It also aimed to evaluate the feeding value of Napier grass silage as basal diet in comparison with locally produced feeds on milk yield of crossbred dairy cows. Sixteen dairy cows (Horro X Friesian) were used for the experiment. All the cows were drenched with broad-spectrum anti- helminthics (Albendazole 500mg) prior to the start of the experiment. The experiment was carried out with full participation of farmers research group. Farmers were participated in the selection of best performed feeding options. Mean daily milk yield of crossbred dairy cows fed napier grass silage and locally produced feeds differed significantly between treatments ($P<0.01$), cows fed with napier grass silage produced more milk yield than those feed locally produced feeds. Accordingly, farmers preferred napier grass silage feeding to locally feed due to its high biomass and milk yield improvement. Thus, it can be concluded that cows fed with Napeir grass silage with recommended concentrate mix optimized both biological and economic benefits as compared to cows consumed locally produced feeds. The technology is liked by farmers and therefore, it needs further extension through pre-scaling up with its full package.

Key words: Crossbred, Demonstration, Locally produced feeds, napier grass silage

INTRODUCTION

In the mixed crop-livestock production systems of the Ethiopian highlands, feed resources for livestock mainly come from marginal pasturelands, crop residues, and crop aftermath grazing (Bogale *et al*., 2008). As most of the lands are occupied by the crops, the importance of crop residue remain high. Nevertheless, forages from marginal pasturelands and crop residues are of generally low quality. Thus, the nutritional requirements of pregnant and lactating cows are not sufficiently met. Under such circumstances, cows in early lactation as well and high producing cows are typically in a negative energy balance. Factors associated with a negative energy balance are known to have adverse implication on reproductive efficiency and milk production and body weight loss of animals (Emebet and Zeleke, 2008). This is further aggravated by the fact that yield and nutritive value of tropical grasses decline sharply as dry season approaches (Babayemi *et al*., 2009), leading to reduced

feed intake, greater weight loss and low milk production from cows raised in extensive production system (Smith, 2001).

The situation may be reversed during the wet season when there are more forage than being used (Higashiyama and Hirata, 2006) and opportunity to cultivate forage is high. Thus, surplus and cultivated quality forages should be conserved during the wet season for use during the dry season. To this effect, silage making is a common means of preserving surplus forage that could be fed to livestock during periods of scarcity (Wong, 2000). By conserving excess forage produced during the wet season to silage (Wong, 2000), the low production and productivity of dairy animals during the dry season due to scarcity of forage can be ameliorated. For such purpose, napier grass, a high yielding tropical grass with great potentials for making silage, could be used.

Napier grass (*Pennisetum purpureum*) is recommended as basal forage for intensive cattle production as its high biomass fresh dry matter yield 40 t/ha compared to other grasses (ILRI, 2001). Napier grass is tall growing perennial grass, which is indigenous to tropical and subtropical climates. Bako Agricultural Research Center, Pennesitum purpureum (ILRI 1681) was found to be promising in terms of biomas, this material was used for the preparation of the silage meant for the present study.

Generally supplementing napier grass with concentrate or leguminous forage plants was reported to improve the production performance of animal (Solomon, 2001). On station evaluation of napier grass (*Pennisetum purpureum*) silage with comparative evaluation of natural grass hay on milk yield, milk composition and body weight of lactating crossbred dairy cow were conducted and significant increment were seen on milk yield by napier grass silage as compared to natural grass hay (Tesfaye et al., 2016). Therefore, in order to verify the importance of the napier grass silage at farmer's level, undertaking the work on-farm was found to be worthwhile. Hence, the present work was proposed with the following objectives: (a) to create awareness on the importance of the technologies among the rural farmers, (b) to enhance the farmers' knowledge and skill on the technological usage and (c) to evaluate the feeding value of napier grass silage as basal diet when offered with locally produced feeds on milk yield of crossbred dairy cattle.

MATERIALS AND METHOD

The present work was conducted in purposively selected district of East Wollega zone. Two potential Kebeles, namely *Nagasa* and *Gari* from district of Guto Gida were selected based on accessibility and potentiality for dairy production. In each kebele one farmers research group unit, comprising of 16 farmers was organized. Gender and youth balance in each farmers research group unit were considered. in each farmers research group unit, eight experimental farmers per kebele were selected with the rest being participant farmers. Development agents and district experts were collaborative in site and farmer selection.

The farmers research group member farmers were selected based on, willingness to be a member of the farmers research group, accessibility for supervision of activities, good history of compatibility with group dynamics, and willingness to share innovations to other farmers. After the establishment of the farmers research group a theoretical training session were arranged to farmers, DAs, and district experts. Researcher from different discipline, drawn from Bako Agricultural research Center (BARC) trained the farmers on dairy nutrition, disease, breeding, milk post-harvest handling and forage conservation and preservation strategy. This training was believed to help the farmers in aspiring the overall objectives of the work.

Napier grass (*Pennisetum purpureum*) planting

Napier grass *(Pennisetum purpureum) 16801 accession* was planted on plot of 30mx30m on each trial farmers' land. A spacing of 50cm between plants and 60cm between rows was used. All the necessary recommended agronomic practices were equally applied for all of the plots on each farmers land.

The napier grass silage feeding for dairy cattle was evaluated against local practice of dairy cattle feeding by farmers' selection criteria. At this junction, the farmers were assisted to jot their own evaluation criteria which was used to rank the technologies (treatments). Napier grass silage feeding for dairy cattle was evaluated against the criteria set by farmers and based on the weight attached to each parameter. At the end of the evaluation process, result of the evaluation was displayed to the evaluators, and discussion were made on the way ahead.

Experimental animals and management

A total of 16 crossbred lactating cows (Horro x Fresian) were selected from the dairy cow keeper farmers and the feeding trail was conducted at each farmer site. Among the 16 crossbred lactating cows, demonstration of napier grass silage was under taken at Guto Gida district (Nagasa and Gari kebele's) on eight hosting farmer's site and fed cows individually at each farmers site. However, cows where fed with locally produced feeds (grazing with home made supplement) also undertaken at the same

kebele on another eight lactating crossbred cows at each farmers site. All the cows were drenched with broad-spectrum anti-helminthics (Albendazole 500mg) prior to the start of the experiment. Farmers, development rgent and district experts were participated on training of silage preparation.

Formulating concentrate mix

A concentrate mixture sufficient for the entire experimental period were formulated on station using milled maize grain and noug seed cake as main ingredients. The formulated ration is composed of 49.5, 49.5, 1% maize grain, noug seed cake, and salt, respectively. It was established at BARC that the mixture fully meet the requirement for major nutrients of lactating crossbred cows with milk yield and butter fat content as described in (ARC, 1990) when fed at the rate of 0.5 kg/l of milk.

Methods of silage preparation

napier grass was harvested at 1m height and the harvested plant was wilted to overcome the high juice losses associated with the ensiling of immature forage. The wilted plants were chopped to lengths of about 5cm using manual chopper. Locally available materials (*Hyparrhenia rufa)* were used to line the sides of the silo. The chopped material were place in the plastic-lined pit and spread uniformly into layers of 15-30cm and compacted. The filled silo pits were covered with polythene sheeting and then loaded with soil on the top. Small trenches were dug around the sides of the pit to ensure water does not seep into the silage material. The silage was used for feeding after one month of ensiling. During napier grass silage preparation farmers research group participated and have got experience from it.

Treatments

1. Farmers practice /locally feeding their lactating cow (grazing + milled maize grain + atella + crop residues + salt).
2. Napier grass silage *adlibtum* + concentrate mix (0.5kg/lit of milk)

Partial budget analysis

A simple partial budget analysis was conducted by using marginal analysis of dietary treatments cost based on calculation of the total cost of supplement feed (concentrate) and basal diet and considering milk sales price and labour cost incurred during the entire experimentation process. Partial budget analysis made by using marginal analysis was employed to compute total cost of production /cow/day, price of milk/cow/day, cost of production/litre of milk, return/cow/day, net return/cow/day and marginal rate of return/cow/day, Calculations were employed as follow;

Net returen (NR) = Total revenue (TR) – Total variable cost (TVC) $\Delta NR=\Delta TR - \Delta TVC$

Marginal rate of return (MRR %) = $\frac{\Delta NR \times 100}{\Delta TVC}$

Statistical Analysis

The data were analyzed by the GLM procedure in the ANOVA program of the SAS (2009) software.

RESULTS AND DISCUSSION

Farmer's ranking of the treatments

Cows fed with napier grass silage produced more milk than cows fed with locally produced feeds, this might be due to the feed quality and cows saved energy lose for searching feed and heat stress. The ranking was conducted on the feeding options of Napeir grass silage feeding with recommended concentrate and grazing with homemade supplementation. However the farmers set criteria of selection technologies by themselves and agreed on it. (table 1 below).

Milk yield

The results of mean daily milk yield of crossbred dairy cows fed napier grass silage and locally produced feeds were significantly different between treatments ($P<0.01$) and cows fed napier grass silage produced more milk yield than those fed on locally produced feeds. The difference in milk yield between treatment groups could be attributed to the differences in crude protein and energy contents in the feeds (Steinshamn, 2010). There are reports in agreement with the current finding. For instance, Adebabay et al. (2009) indicated that supplemented cows produce significantly more milk than those grazed on natural pasture alone. (Table 2 below).

Farmers feed back

The farmers were highly interested on the silage of napier grass due to the high biomass of the grass, frequency of harvesting per year and suitability for preservation surplus feeds as silage. The milk yield of dairy cattle

Table 1. Ranking of napier grass silage and locally practiced feeding for dairy cattle technology by the farmers research group farmers.

Criteria	Technology Rank			
	Guto Gida (Gari PA)		Guto Gida (Nagasa PA)	
	T_1	T_2	T_1	T_2
Biomass of the feed	2nd	1st	2nd	1st
Body condition of the animal	2nd	1st	2nd	1st
Utilization methods of the feed	2nd	1st	2nd	1st
Palatability of the feed	2nd	1st	2nd	1st
Milk yield increment	2nd	1st	2nd	1st
Intensive management and input	2nd	1st	2nd	1st
Utilization and sustainability of the feed	2nd	1st	2nd	1st

Note: T1 = Control (farmers practice) /locally feeding their lactating cattle (grazing + milled maize grain + atella + crop residues+ salt)
T2= Napier grass silage *adlibtum* + concentrate mix (0.5kg/l of milk)

Table 2. Effect of feeding napier grass silage and locally produced feeds on milk yield of crossbred dairy cows at Guto Gida districts

Parameters	Feed type	
	Napier grass silage feeding (T2)	Locally produced feed feeding (T1)
Mean Milk Yield	8.44[a]	5.31[b]
Number of cow	8	8
Standard error	0.32	0.16

Note: T1 = Control (Farmers practice) /locally feeding their lactating cattle (grazing + milled maize grain + atella + crop residues + salt)
T2= Napier grass silage *adlibtum* + Concentrate mix (0.5 kg/lit of milk)

Table 3. Partial budget analysis for lactating crossbred dairy cows fed napier grass silage and locally produced feed basal diet and supplemented with concentrate mix (0.5kg/1 milk).

	Treatments	
Variable	T1	T2
Milk yield (kg/cow/day)	5.31	8.44
Gross field benefit (ETB /cow/day)	95.58	151.92
Cost of grazing (ETB/ kg /cow/day)	-	-
Cost of napier grass silage (ETB/ kg /cow/day)	-	10.67
Cost for concentrate mix (ETB/kg/cow/day)	15.90	19.5
Cost of tablet, salt and labour (ETB /cow/day)	40.15	40.15
Total variable cost (ETB /cow/day)	56.05	72.32
Gross income, ETB/head	95.58	151.92
Net benefit (ETB cow/day)	39.53	81.6
Change in net income (ETB)	0	42.07
Change in total variable cost (ETB)	0	16.27
MRR, %	0	259

ETB = Ethiopian Birr; MRR = Marginal rate of return;
T1= locally produced feeds *(*grazing + milled maize grain + atella + crop residues+ salt*);*
T2=Napier grass silage + concentrate mix (0.5kg/l of milk) ,Concentrate mix = 49.5% maize grain + 49.5% noug seed cake + 1% salt

fed, these silage were increase as compared to locally produced feed. However, the farmers commended the technology and preferred it with full package like chopper. The farmers use manual chopper which is time consuming. Therefore, the agricultural engineering and mechanization should think over on the

production of the right chopper for the napier grass silage production.

Partial budget analysis

The economic feasibility of this study was analyzed using partial budget and marginal analysis approaches. According to this analysis, T2 gave higher net benefit (Birr 81.6 per cow/day), than T1 (Birr 39.53 per cow/day). The minimum rate of return acceptable by the dairy farmer was assumed to be 50% (CIMMYT, 1985). This implies that the dairy farmer expects a minimum rate of return of 50% if he is to adopt a new practice as compared to the practice he used to do.

Between treatments, the largest change in cost that varies was birr 16.27 per day and the change in net income was birr 42.07 per day resulting in 259% marginal rate of return was recorded for T2. So for each birr invested as input for a cow, the farmer will recover birr 1(one) and an additional birr 42.07 at a given prices. Therefore, on the basis of MRR the technology is recommended for increasing milk productivity of cows. The result of MRR of the present study was in the profitable range like as 158% and 131.85% reported by Shah et al. (2009) who worked on an on-farm trial of urea mineral molasses blocks fed to milking cows and buffaloes, respectively. Therefore, considering milk yield and economic return in this study, it can be concluded that cows fed with basal diet of napier grass silage with recommended concentrate mixture optimize both biological and economic benefits as compared to cows consumed with locally produced feeds. (Table 3 above).

CONCLUSION AND RECOMMENDATION

The activity was carried out with full participation of farmers research group farmers and it was conducted on sixteen dairy cattle of selected farmers. The results of mean daily milk yield of crossbred dairy cows fed with napier grass silage were significantly improved as compared to milk from locally produced feeds. Farmers participated in the selection of best performed feeding option. Different parameters like biomass of the feed, body condition of the animal, utilization methods of the feed, palatability of the feed, milk yield increment, intensive management and input, utilization and sustainability of the feed were evaluated for each feeding option. Accordingly, farmers preferred napier grass silage feeding than locally produced feed due to high biomass of the grass and milk yield improvements. The technology is liked by farmers and therefore it needs further extension through pre-scaling up with its full package. Since the silage preparation is the primary system of feed preservation and conservation strategy during feed scarcity, napier grass is an option for silage making due to the nature of the forage and its high biomass. Thus, considering milk yield and economic return in this study, it can be concluded that cows fed with Napeir grass silage with recommended concentrate mixture optimize both biological and economic benefits as compared to cows fed with locally produced feeds.

ACKNOWLEDGEMENT

The financial support of Agricultural Growth Program II is gratefully acknowledged. The authors are also grateful to dairy research team member of Bako agricultural research Center for facilitating different supports required during the conduct of the research work

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