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Pre-Scaling out of Urea Cactus Block and Urea Treatments Feed Technology for Enhance Dairy Production: In the Case of Raya-Azebo and Enda-Mekoni Woreda

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Abstract: Feed shortage is one of the constraints for livestock production in Ethiopia and it is major focus of the livestock theme in the target areas of the project. In this line, different types of demonstration trials were conducted in Southern Tigray. In the study area, local practice and local practice plus supplementation of improved feed were considered as control and treatment, respectively. Carry-over effect design was used to collect feed intake and milk yield over 90 days. The data collected from the experiment were subjected to analysis of variance using the General Linear Model Procedure of SAS (SAS 1998). Significant treatment means were separated using Turkey HSD. On farm supplementation of urea cactus block and urea treatment had increased milk production by 1 and 1.8 L/day/cow, respectively. Across all feed technologies, animals without any supplementation gave significantly ($p<0.05$) lower milk yield compared to supplemented. The marginal rate of return of urea cactus block (3.8 birr/day/cow) and urea treatment (2.2 birr/day/cow) were higher compared to non-supplemented cows. Farmers participated on feeding urea cactus block and urea treated straw observed improved milk productivity on their cows. Generally, the performance of feed technologies interventions on milk and body weight gain was generally positive with promising economic return.

Key words: Cows, feed, milk yield, urea cactus block, urea treatment

INTRODUCTION

In the highland of Ethiopia crops residues such as barley, wheat and teff straws contribution is significant as animal feeds (1988; Seyoum and Zinash, 1989). According to Seyoum and Zinash (1989), the mean CP content of barley and wheat straw was dry matter of 6.2 and 2.4%, whereas that of teff straw was 6%. Low (42 g kg^{-1} DM) value of CP for teff straw was also reported by Melaku *et al.* (2004). Ensminger *et al.* (1990) also indicated that the CP content of barley straws average about 5.2%, whereas wheat straw contains about 3.2% of DM. Yitaye reported that the IVDMD values of 50.96 and 34.86% for barley and wheat straws, respectively. Generally, species, agronomic practices, soil and temperature, stage of growth influence the chemical composition, morphology and palatability of straws. Cereal and stovers that form the bulk of crop residues are characterized by low digestibility (<50%), low Metabolizable Energy (ME) content (<7.5 MJ kg^{-1} DM), low CP content (<60 g kg^{-1} DM) and low content of available minerals and vitamins. Hence, severe weight losses will occur when animals are fed only on such feed resources. Usually, their nutritive value is low, mainly because they are deficient in nitrogen and energy contents.

All the straws and related by-products are extremely fibrous, most have a high content of lignin and all are of low nutritive value. Their fiber content restricts their use as feed for ruminants (McDonald *et al*., 1995). Generally, because of poor nutrient contents and digestibility and insufficient nitrogen content, cereal straws fail to meet the productive function of livestock (Seyoum and Zinash, 1989; Cheeke, 1999). Commonly in the study area the crop residue straw was provided to livestock without any improvement such as physical, chemical or concentrate supplementation. As a result, the productivity of livestock

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is below the expectation of the regional demand as well as national. Crop residues cannot fulfill the nutritional requirements of the animals particularly during the dry season, due to poor management and their inherent low productivity and quality. Over all enhancing the productivity of animals through treatment and supplementation is vital to improve their quality. This can be done either through physical and chemical treatments or through supplementation with energy and/or protein rich agro-industrial by-products. Therefore, the operational research project was initiated to improve livestock production and productivity through supplementation of improved feed technologies.

MATERIALS AND METHODS

Area description: Raya-Azebo woreda has altitude ranging from 930-1800 m above sea level. This woreda covers three climatic zones: lowland (18.6%), midland (80%) and highland (1.4%). The woreda receives annual average rainfall of 400-700 mm. Farming activities depend on the February to May Belg rains and the July to September Kiremti rains. The main crops cultivated are sorghum, teff and maize. Sorghum is the staple food and teff is produced for both food and cash income. Enda-Mekoni woreda is situated from 1800-3925 m.a.s.l and found 662 km from Addis Ababa and 120 km from the Regional capital, Mekelle. The Woreda is consists of 19 rural kebeles and 2 urban Kebeles. Topography of the area can be classified as very steep 65%, steepl 2%, gentle 15% and valley 8%. Average land holding is about 0.5 with a minimum and maximum of 0.25 and 0.75 ha, respectively. Mean annual rainfall is 650-950 mm ranging. Belg (small rains) and Keremti (long rainy season) are the two cropping seasons. The dominant soil type in the Woreda plains is clay soil, loam and sandy soil while the medium and high altitude areas. The mean annual temperature of the woreda is between 12 and 18°C.

Beneficiary selection and selection procedure: A total of 100 safety net beneficiaries household who are recipient of the Productive Safety Net Program (PSNP) and interested to join the program were selected. Moreover, the experience of the households on their previous practices to participate on livestock production activities, availability of enough space for housing with a run, living standard and initiations were considered as selection criteria. Practical and theoretical training was provided to woreda experts, DAs and farmers which enable them to develop skill on the general management practices of improved feed technologies such as urea cactus block and urea treatments. There were also regular backstopping to the target farmers by the researchers and DA's on how to follow up the health of the animals, how to keep the animal house clean and dry, how to keep records of milk produced and other essential management practices, etc.

Description of technology: A total of 1350 blocks were produced by Bokra union distributed to farmers to supplement their animals. Urea and plastic sheet for urea treatment technology were purchase from cooperative and local market. Feed technology includes urea cactus block and urea treatment. The amount of ingredients of urea cactus block and urea treatment are given:

- Cactus juice 40%, urea 4%, wheat bran 25%, noug seed cake 16%, cement 10%, salt 5%
- Urea 4-5 kg, water 40-80 l, straw 100kg, fermented for 21 days

Cross over effect design was used to collect all milk yield. In this design, a single animal is used as a control and trial. Farmers were considered as replication in each technology demonstration. Cows were supplemented free choices with UCB and urea treatments:

- T1 = Local practice+Supplementation with improved feed
- T2 = Local practice

Data collection and analysis: A total of 15 and 26 farmers were participated in research action approach on urea cactus block and urea treatments technologies, respectively. Similarly, 14 and 28 dairy cows were used as experimental animals for urea cactus block and urea treatment technologies, respectively. Dairy cows on mid lactation period (3 months) were used as experimental unit for both feed technologies. Milk yield was collected for 90 days on morning and evening. The data collected from the experiment were subjected to analysis of variance using the General Linear Model Procedure of SAS (SAS, 1998). Significant treatment means were separated using Tukey HSD. Farmers' perception were collected through semi structure questioner and analyzed through SPSS Software using descriptive statistics. Economic analysis was conducted using standard partial budget analysis guideline of CIMMIT.

Laboratory analysis: Feeds were ground to pass through a 1 mm sieve screen size. The grounded samples were analyzed for contents of dry matter, ash, nitrogen, neutral detergent fiber, acid detergent fiber and acid detergent lignin following the procedure by AOAC (1990).

Table 1: Chemical composition of diets

Feeds	DM	CP	OM	NDF	ADF	ADL	Ash	IVOMD
Urea cactus block	86	30	73	36	13	5	27	58
Urea treated straw	64	14	93	75	49	5	7	59
Untreated straw	90	23	91	81	60	5	9	33

NB: DM = Dry Matter; CP = Crude Protein; OM = Organic Matter; NDF = Neutral Detergent Fiber; ADF = Acid Detergent Fiber; ADL = Acid Detergent Lignin and IVOMD = *In vitro* Organic Matter Digestibility

RESULTS AND DISCUSSION

Chemical composition of supplement diets: The crude protein content of urea cactus block and urea untreated straw were 30 and 2.3 %, respectively (Table 1). Moreover, urea treated straw had higher *in vitro* organic matter digestibility (59%) than urea cactus block (58%) and straw (33%). In the present study, the crude protein content of crop residue was below maintenance requirement of animals (23 g kg^{-1} DM).

Dry matter and nutrient intake: The daily dry matter and nutrient intake of dairy cows is given in Table 2. Cows supplemented with urea cactus block and urea treatments had an additional dry matter intake of 400 and 3150 g/day/head compared to non supplemented cows. This high dry matter intake of feed made the animals to received 176 and 315 g/day/head crude protein from cactus block and urea treated straw, respectively. This implies that an increment of protein intake leads the cows to increase their milk and meat production.

Milk yield production: Daily milk yield of cows supplemented and non-supplemented with UCB is given in Table 3. Cows supplemented with UCB had highest values ($p<0.1$) compared to non-supplemented cows. Cows supplemented with urea cactus block had increased milk yield by 1 L compared with non-supplemented cows. Similarly, cows supplemented with urea treated straw had significantly higher milk yield ($p<0.05$) compared to non-supplemented ones. The current results show that cows supplemented with urea treated straw increased milk yield by 1.8 L day^{-1} compared with non-supplemented ones. Increased milk yield from cows fed with urea treated straw would be due to the physical and chemical modification of straw cell matter by urea reaction which also assists the degradation of this residue by rumen micro-organisms. Similarly, the crude protein content of urea cactus block and urea treatments was increased that can satisfy the requirements of maintenance as well as production.

Partial budget analysis of supplements diets: In the current study in South Tigray the marginal rate of return for urea cactus block and urea treatment were 3.8 and 2.24, respectively. This implies that both demonstrated feed technologies had positive marginal rate of return. Cows supplemented with improved feed technologies increased benefits for each additional unit of 1 birr per milk cost increment results in 1 birr and additional marginal rate of return (Table 4).

Table 2: Dry matter and nutrient intake

Feeds	DM intake (g/day/head)	CP intake (g/day/head)
Urea cactus block	400	176
Urea treatments	3150	315

Table 3: Daily milk yield on supplemented and non-supplemented feed technologies

	Milk yield (L day^{-1})	
Treatments	Urea cactus block	Urea treatment
Supplemented	3.300^{a}	3.9^{a}
Non-supplemented	2.300^{b}	2.1^{b}
SE	0.088	0.1
SL	*	*

SE = Standard Error; SL = Significant Level *$p<0.1$

Farmers' perception: Farmers perceived that urea cactus block and urea treatments had good smell and softness. They observed that due to good smell and softness of the feed animals were able to lick and uptake more and easily. Feeding animals with both feed technologies had been increased water and feed intake. Farmers observed that increment of body weight after supplemented with improved feed. On average about 0.5 and 1.4 L day^{-1} milk yield difference was observed while animals supplemented with urea cactus block and urea treatments, respectively. Moreover, all participant' farmers observed that health and external body condition improvement while supplemented with protein source (Table 5).

Low values of crop residue are likely to depress intake and digestibility of the straw (Van Soest, 1982). On the other hand urea treated straw had higher Crude Protein (CP) and organic matter digestibility compared to untreated straw. Similarly, the crude protein content of urea cactus block and urea treatments was increased that can satisfy the requirements of maintenance as well as production. This implies that cows supplemented with improved feed can easily digest the feed and increase more feed up take. Similarly, Preston reported that any increase in protein intake lead to increase apparent digestibility of crude protein. In line with this, Srinivasulu *et al.* (1999) found that urea treatment increased CP content of the straw more than doubling in percentage units from 3.35% (30.99 g kg^{-1} DM) to 7.54%

Table 4: Partial budget analysis supplements diet

	Urea cactus block		Urea treatment	
Parameters	Control	Supplemented	Control	Supplemented
Cost of urea (ETB)	0	3.60	0	40.00
Cost of Wheat bran (ETB)	0	4.05	-	-
Cost for noug cake (ETB)	0	3.60	-	-
Cost for cement (ETB)	0	1.00	-	-
Cost for salt (ETB)	0	1.05	-	-
Labor costs (ETB)	0	5.00	0	45.00
Cost of plastic sheet	-	-	-	140.00
TVC	0	18.30	0	225.00
Gross income (ETB/10 days)	207	297.00	850	1579.50
Total return (ETB/head)	0	90.00	850	1354.50
Net return (ETB/head)	0	71.00	0	504.50
ΔNR	-	71.00	-	504.50
ΔTVC	-	18.30	-	225.00
MRR (ratio)	-	3.80	-	2.24
MRR (%)	-	380.00	-	224.00

Table 5: Farmers' perception indictors on supplements diets

	Farmers perception on feed technologies							
	Urea cactus block (N = 11)				Urea treatments (N = 8)			
Parameters	Poor	No change	Good	Very good	Poor	No change	Good	Very good
Smell	37.5	12.5	50.0	-	9.10	-	72.70	18.20
Softness	-	-	25.0	75.0	9.10	-	81.80	9.10
Palatability	-	-	50.0	50.0	9.10	-	54.50	36.40
attractiveness	-	-	75.0	25.0	-	-	72.70	27.30
Adaptability	-	-	75.0	25.0	9.10	-	63.40	27.30
Feed intake	-	-	37.5	62.5	9.10	-	36.40	54.50
Water intake	-	-	37.5	62.5	9.10	-	9.10	81.80
Body weight gain	-	-	75.0	25.0	18.20	27.30	36.40	18.20
Milk yield	-	-	62.5	37.5	9.10	-	54.50	27.30
Health status	12.5	-	-	12.5	-	-	90.90	9.10
External appearance	-	-	75.0	25.0	9.10	9.10	63.60	18.20

(70.21 g kg^{-1} DM), an increase by 125%, due to binding of ammonia to the straw. Increase in IVOMD from 30.8-49.4% (increased by 8.26%) due to better solublization of hemicelluloses and swelling of cellulose during urea treatment was reported by Singh. Similarly, Preston and Leng reported that treatment of straw increases digestibility by 5-10% compared to the untreated straw.

In line with the current study, joint FAO/IAEA program RAS/5/035 project reported that urea molasses block consumption increased voluntary feed intake by up to 30%; milk production by 6-100%. In line with this, Biswas *et al.* (2010) reported that urea molasses block consumption increased milk production by 1.43 L day^{-1}. Similarly, Kunju (1986) reported improvement in milk yield due to UMMB lick supplementation to paddy straw in low yielding cattle. In agreement with the present study, Akter *et al.* (2004) reported that supplementation of urea molasses block to cows also receiving straw based diets increased milk production from 2.86-4.43 L day^{-1}. Moreover, Chen *et al.* (1993) observed that cows having access to UMMB licks had an average milk yield of 20.7 kg day^{-1} which was 1.3 kg higher than the average of the control group. Similar with the current results urea treated straw replace native hay and producing superior milk yield about 1.16-6.2 kg milk/day compared to non-supplemented (Dejene *et al.*, 2009; Hussien *et al.* 2011).

In the current study, the marginal rate of return for urea cactus block and urea treatment were observed positive and >1. Biswas *et al.* (2010) also observed that feeding urea molasses straw was reducing milk production cost by 0.5 $/litter/day. In line with this, joint FAO/IAEA program RAS/5/035 project observed increased dairy farmer income by 5-180% per cow per day by supplements urea molasses block. Similarly, Vijayalakshmi indicated that milk yield at early, mid and late lactating in cows both at rural and urban had clearly shown that urea treated straw based feeding to be economical. Feeding experiments with treated barley and teff straw using concentrate as a supplement by Reherahie has also proven to be economically feasible in Ethiopia.

CONCLUSION

Due to improvement milk yield from these technologies, economic benefits were higher in animals treated with improved feed than non-supplemented ones.

The marginal rate of return for UCB and urea treated were higher in animals supplemented than non-supplemented. All technologies ingredient used for preparing the improved feed is locally available and as such no problem is foreseen in future. All technologies relies on locally available resources and don't use inputs which could have environmental problems. Therefore, it can be concluded that those technologies were perceived as good options of feed improvement as well as additional income generation in the South Tigray region.

REFERENCES

AOAC., 1990. Official Methods of Analysis of the Association of Official Analytical Chemists. 13th Edn., Association of Official Analytical Chemist, Washington, DC., USA.

Akter, Y., M.A. Akbar, M. Shahjalal and T.U. Ahmed, 2004. Effect of urea molasses multi-nutrient blocks supplementation of dairy cows fed rice straw and green grasses on milk yield, composition, live weight gain of cows and calves and feed intake. Pak. J. Biol. Sci., 7: 1523-1525.

Biswas, M., M. Hoque, M. Kibria, M. Rashid and M. Akther, 2010. Field trial and demonstration of urea molasses straw technology of feeding lactating animals. Bangladesh Res. Publ. J., 3: 1129-1132.

Cheeke, P.R., 1999. Applied Animal Nutrition Feed and Feeding. 2nd Edn., Prince Hall Inc., New Jersy, Pages: 525.

Chen, Y.Z., H. Wen, X. Ma, Y. Li and Z. Gao *et al*., 1993. Multinutrient lick blocks for dairy cattle in Gansu Province China. Livestock Res. Rural Dev., 5: 60-63.

Dejene, M., S. Bediye, A. Kehaliw, G. Kitaw and K. Nesha, 2009. On-farm evaluation of lactating crossbred (Bos taurus x Bos indicus) dairy cows fed a basal diet of urea treated teff (Eragrostis tef) straw supplemented with escape protein source during the dry season in crop-livestock production system of north Shoa, Ethiopia. Livestock Res. Rural Dev., Vol. 21.

Ensminger, M.E., J.E. Oldfield and W.W. Heinemann, 1990. Feed and Nutrition. 2nd Edn., Ensminger Co., California.

Hussien, R., F. Tegegne, , Z. Yilma, , Z. Mekuriaw and M. Taye, 2011. Feed intake, milk yield and milk composition of fogera cows supplemented with different feeds. World's Vet. J., 3: 41-45.

Kunju, P.J.G., 1986. Urea molasses block: A future animal feed supplement. Asian Livestock, 12: 154-159.

McDonald, P., R.A. Edwards, J.F.D. Greenhalgh and C.A. Morgan, 1995. Animal Nutrition. 5th Edn., Prentice Hall, London, Pages: 607.

Melaku, S., K.J. Peters and A. Tegegne, 2004. Effect of supplementation with foilages of selected multipurpose trees, their mixtures or wheat bran on feed intake, plasma enzyme activities, live weight and scrotal circumference gain in Menz sheep. Livest. Prod. Sci., 89: 253-264.

SAS, 1998. Statistical Analysis System Institute: Stat View Reference Manual. SAS Institute, Cary, NC., USA.

Seyoum, B. and S. Zinash, 1989. The composition of Ethiopian feeds. Research Report No. 6. IAR, Addis Ababa, Ethiopia.

Srinivasulu, C., M.R. Reddy and G.V.N. Reddy, 1999. Effect of gliricidia leaves supplementation to urea treated paddy straw on milk production in crossbred cows. Indian J. Anim. Nutr., 16: 30-33.

Van Soest, P.J., 1982. Nutritional Ecology of the Ruminant and B. Books. Inc. Corvallis DR.