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Nutritive Value of Urea Molasses Block Containing Acacia Erubescens or *Dichrostachys cineria* as Natural Protein Sources

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Abstract: This study was aimed at developing Molasses-urea Blocks (MUB) for purposes of providing supplementary feeding that will supply crude protein and minerals to ruminant livestock during drought periods. In order to accomplish this, urea, molasses, sorghum bran, *Acacia erubescens* or *Dichrostachys cineria* as local browse trees in Botswana and dicalcium phosphate as a commercial mineral ingredient, salt and cement were used. Cement was used as a cold binder and roughages such as grass hay or Lucerne were also used in some MUB and their nutritional contents were compared to those containing browse plants. Dry matter, crude protein and mineral contents were analyzed using proximate analysis. All the 4 blocks hardened within 5-7 days and yielded dense blocks. MUB containing Acacia erubescens and Lucerne had higher nutrient contents than MUB containing *Dichrostachys cineria* and grass hay. All the macro mineral contents were within the normal range required for maintenance by grazing animals. Dry Matter (DM), Crude Protein (CP), Ash, Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF), Acid Detergent Lignin (ADL) and *in vitro* DM digestibility differed ($p<0.05$) between MUB types evaluated. All the MUB had crude protein content varying from 11.83-26.58%. Average mineral content (%) of all MUB were 16.33, 9.35, 5.38, 1.09 and 0.27 for P, Ca, Mg, Na and K, respectively. Also some of the trace minerals Fe (%), Mn and Zn (ppm) had average values of 0.098, 0.018 and 0.002, respectively.

Key words: Nutritive value, urea molasses block, natural protein sources, ADF, ADL

INTRODUCTION

The Livestock sub-sector in Botswana is the major activity of the Agricultural sector. It contributes to food production by providing milk and meat for human consumption as well as for sale. The beef cattle industry in particular contributes to the country's foreign exchange earning through export of beef and animal by-product. Despite the high contribution of the beef industry in the country's Agricultural share of Gross Domestic Products (GDP) no significant changes have occurred in the way livestock producers feed their livestock in order to improve production. Possible reason contributing to low adoption of technologies of promoting livestock production by both traditional and commercial livestock producers include among others is a lack of framework that integrates all aspects of beef production, the frequent occurrence of drought which affects pasture production on rangeland and mismanagement of the environment through overstocking.

Drought is a common phenomenon in Botswana. Livestock nutrition especially energy and protein are limiting factors in the dry season leading to low livestock production. Mackenzie (1967), reported that in times of drought when energy and protein reserves fall to a low level, molasses-urea mixture fed in amounts of up to 2 kg a day can help satisfy both energy and protein needs for maintenance. The major limiting factor is the scarcity of the resources used to alleviate the situation and if found they are not cheap. Rural people who depend solely on agricultural production mostly feel the impact of drought. In addition, these feeds are expensive and therefore difficult for the small holder farmers to supplement their grazing livestock.

In Botswana, there is a wide diversity of browsable plant material on ranges for livestock (Aganga, 2002). These include pods and twigs of shrubs and trees as well as dried leaves, which livestock pick under trees. Pods of *Acacia erubescens* and *Dichrostachys cineria* have high crude protein content and can serve as cheap protein source in compounding supplementary diets for livestock. The genus Acacia is a large group of woody trees and shrubs of the family *Leguminosaceae*. The African species of Acacias all have thorns on the twigs hence the

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common name of thorn trees. *Acacia erubescens* is found in many parts of Africa and is widespread and common throughout Botswana. *Acacia erubescens* is a browse tree with leaves that are excellent fodder and are available when there is no grass (Gohl, 1981). *Dichrostachys cineria* is also found in many parts of Botswana and it is browsed by grazing animals during dry season (Aganga, 2002). *D. cineria* is a shrub with binate leaves borne on angular branch lets with spines. Fruits and leaves of *D.cineria* are eaten by several species of wild and domestic ruminants. It has been established that seeds in pods of browse pass through the digestive tract intact indicating that the seeds are not digested hence no nutrient are utilized or absorbed from them (Aganga and Mosase, 2001). It is, therefore, necessary to mill the pods along with the seeds for animals to benefit from the nutrient contents. The problem of poor nutrition that affects the performance of livestock in Botswana is addressed by developing and evaluating supplementary MUB containing local tree fodders's pods with seeds in this case that of *Acacia erubescens* and *Dichrostachys cineria*. This will offer an alternative supplementary source of protein to livestock, which depend on native rangelands for feed. The objective of this study is to develop a cost effective MUB using cheap *Acacia erubescens* and *Dichrostachys cineria* twigs, leaves and pods as natural protein sources which the resource poor farmers could easy obtain from the ranges.

MATERIALS AND METHODS

The study was conducted in Botswana College of Agriculture (BCA), Gaborone. Browse legume foliage (leaves, pods and twigs) were randomly harvested from *Acacia erubescens* and *Dichrostachys cineria* trees from BCA rangelands. Both green and dry pods were collected together with their twigs and leaves then dried and milled before mixing into urea -molasses blocks. The following ingredient were used to prepare the urea molasses blocks (Table 1). Beef cure is a liquid molasses mixture containing 300g Kg^{-1} moisture, 260g kg^{-1} CP, 65g kg^{-1} urea, 10g kg^{-1} Ca, 5 g kg^{-1} P, 45g kg^{-1} K, 12g kg^{-1} Mg and 10 g kg^{-1} S. Trace mineral contents (mg kg^{-1}) are 250, 220, 220, 50, 25, 0.5 and 0.5 for Fe, Mn, Zn, Cu, I, Co and Se, respectively.

Table 1: Constituents composition of urea block

Constituents	Percentages
Liquid molasses (Beef cure)	55
Urea	5.0
Dicalcium Phosphate	1.0
Salt	2.0
Cement	10
Sorghum	17
Grass/Lucerne or Dicrostachys cineria or Acacia erubescens	10
	100%

Chemical composition of all ingredients were determined using the procedures of AOAC (1996) and cell wall constituent (NDF, ADF and ADL) (Van Soest *et al.*,1991) {DM, ash and CP (N×6.25). Rumen fluid for *in vitro* studies was collected in the morning then blended and flushed with CO_2 throughout to maintain anaerobic condition and incubated in Daisy incubator. The mineral compositions were determined by using atomic absorption spectrophotometer (GBC 908 AA, Victoria, Australia). Flame photometer (Corning Flame Photometer 410) was used for potassium and sodium determination while uv/visible spectrophotometer (Shimad zu UV-1601PC) was used for phosphorus determination. Data obtained on chemical composition and *in vitro* DM digestibility were subject to Analysis of Variance (ANOVA) and treatment means were compared using Duncan's multiple range test at alpha($p<0.05$) level of significance following the SAS (2004) procedure.

RESULTS AND DISCUSSION

Data on chemical composition are presented in Fig.1-3 which show major minerals, crude protein, % NDF, ADF, ADL and *in vitro* dry matter digestibility.

The CP contents show that there was no significant ($p>0.05$) difference between MUB containing *Acacia erubescens* and Lucerne while significant ($p<0.05$) difference was observed between MUB containing hay grass and *Dichrostachys cineria*. The mineral content

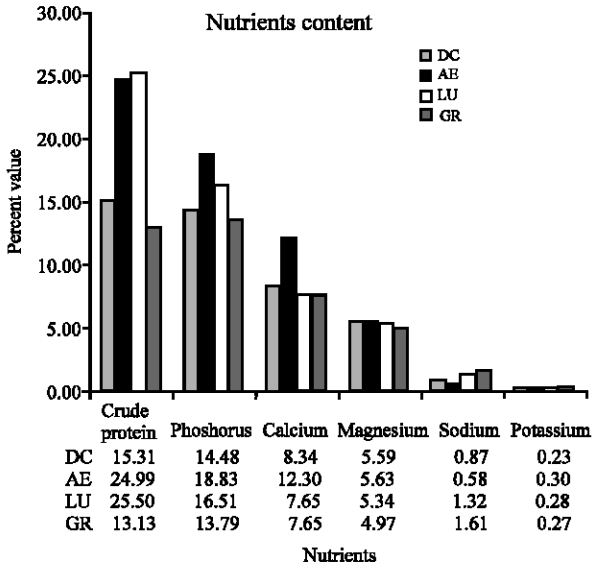

Fig. 1: Mean chemical composing

shows high phosphorus contents in all the blocks which is as a result of the Dicalcium phosphate that was added in the formulation of the MUB. Phosphorus is deficient in the soils in Botswana therefore, it is important to provide phosphorus supplement to grazing livestock in the country. Ash content was 29.61 on average which is required to meet the mineral requirements of the grazing animals. All browse forage species had high fiber fraction shown by high NDF values of 28.71% for MUB containing *Acacia erubescens* and 28.36% for MUB containing Lucerne. The chemical composition of all the blocks are shown in Table 2 and 3. Calcium content of the MUB ranged from 7.65-9.75 g/100g on dry matter basis. Sodium content of the MUB varied from 0.58-1.32 g/100 g. The animals can only access minimal quantities each time they lick the MUB since all the ingredients are bound together in the solid MUB. Table 3 show the *in vitro* dry matter digestibility as well as other chemical contents of the MUB. The IVTD ranged from 83.6-92.9 % which shows that the animals will benefit from most of the nutrients in the MUB as a result of the high digestibility values.

Figure 3 shows MUB *in vitro* DM digestibility which were high and no significant differences in digestibility values between MUB containing *Dichrostachys cineria Acacia erubescens*, Lucerne and hay grass. High crude protein and lower fiber composition indicated that urea molasses block has potential as nitrogen supplement to ruminant grazing low quality forages. Incorporation of indigenous tree fodders into MUB will provide grazing animals with natural nitrogen sources along with the non-protein nitrogen from urea to meet their requirements and will enhance utilization of these feed resources. Utilization of low quality forages, for example dry standing grass hay is constrained by low nitrogen (protein) content especially during the long dry season in Botswana. MUB supplement will provide efficient nitrogen source for feed digestibility and utilization of nutrients. The CP contents are above the adequate range (13-25% CP) for maintenance and growth requirements of goats, sheep and beef cattle. *Acacia* species and *Dichrostachys cineria* are readily available in Botswana rangelands therefore livestock farmers could easily lop the browses and use in the manufacture of MUB.

Neutral Detergent Fibre (NDF) and Acid Detergent Fibre (ADF) are the major determinants of overall forage quality (Van Soest, 1994). The NDF content of the MUB ranged from 11. 76-35.64% while that of ADF ranged

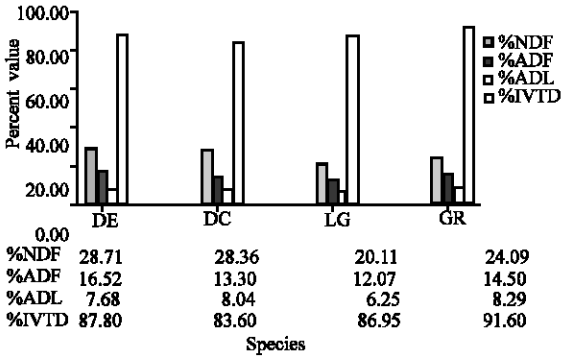

Fig. 2: Chemical composition and digetibility of blocks

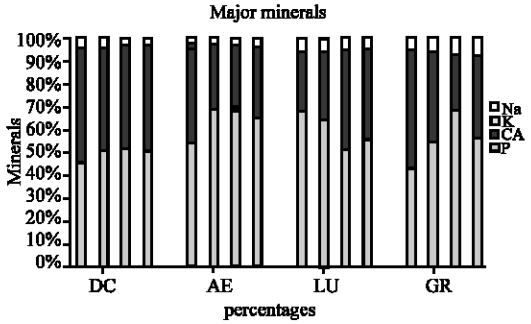

Fig. 3 : Major minerals

Table 2: Mineral composition of Urea blocks

	Major minerals					Minor minerals			
Samples	Ca	P	K	Na	Mg	Cu	Fe	Mn	Zn
AE	9.75	20.52	0.30	0.58	5.63	0	0.16	0.19	0.002
DU	7.65	14.82	0.23	0.87	5.59	0	0.49	0.01	0.005
LU	7.71	16.51	0.28	1.32	5.34	0	0.07	0.02	0.001
GR	7.65	13.79	0.26	0.87	4.97	0	0.05	0.01	0.001

key: All figures are means in % AE = Acacia Erubescens, DR = Dichrostachys cineria, LU = Luceme, GR = Grass

Table 3: Nutrient composition in percent of Urea blocks

Samples	DM	CP	NDF	ADF	ADL	ASH	IVTD
AE	96.58	24.99	14.83	17.5	10.49	26.67	92.9
DC	92.45	15.31	14.76	11.75	10.35	27.95	86.4
LU	89.42	16.51	28.71	12.57	11.89	29.27	83.6
GR	92.45	13.79	20.98	11.59	10.13	27.95	85.7

Key: AE = Acacia Erubescens, DR = Dichrostachys cineria, LU = Lucerne, GR = Grass

from 7.00-20.59% composition was higher than the ruminant animal requirements. During the dry season when the quality of pasture is poor and can not provide the essential nutrients needed by livestock it is recommended that livestock should be provided with MUB containing indigenous browses. Aganga *et al.* (2005) fed Tswana sheep using MUB blocks based on agro-industrial by-products and they reported that it was cost effective and also served as an excellent source of nitrogen.

A study to develop a suitable Multnutrient Feed Block (MNB) using cheap agricultural by-product available in Cameroun and to evaluate the effect of their supplementation on productive performance of Djallonke was conducted by Boukila *et al.* (2006). Assessment of molasses-urea blocks for goats and sheep production in Sutanate of Oman; Intake and growth studies was carried out to develop a Molasses Urea Block (MUB) for the purpose of supplementing trace mineral to domestic ruminant livestock in Oman (Forsberg *et al*., 2002). The results showed an increase in consumption of the MUB and weight of the goats. The slow ingestion of urea provided through such licks ensure its efficient non-toxic utilizations; however, the formulation, production, packaging and feeding of MUB requires critical attention to ensure their regular and practical use by farmers.

Ruminants' production by smallholder farmers in Botswana depends on communal rangelands on which cattle and small stock graze poor quality grass in the form of standing hay with low crude protein and low digestibility resulting in poor utilization. The cattle grazing on natural ranges loose a lot of weight during the dry season and this can be prevented by supplementing the animals with MUB containing dry milled tree fodders which is a good source of cheap and locally available protein supplement.

CONCLUSION

It can be concluded that MUB (molasses-urea blocks) containing browse twigs, leaves and pods are highly nutritious and can contribute substantially to the diet of livestock on communal ranges in Botswana and other arid and semi-arid areas of the world. Therefore, utilization of browse fodder as protein supplements could be optimized by adding non- protein nitrogen sources such as urea, along with molasses and micro nutrients into urea-molasses blocks.

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