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Formulation and cost assessment of three protein lick block supplements in Adamawa State

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Abstract

Traditional livestock owners have recently been discouraged from incorporating the conventional block licks available in the market to the livestock diets. This is due to high cost, which makes it unaffordable to the majority of the small-scale farmers. These farmers are unaware that the lick blocks can be formulated with the non-conventional local resources. This experiment was conducted to substitute the conventional molasses with nonconventional local resources, *assess the cost of compounding different Protein Lick Blocks (PLB) and determine their acceptability by Yankasa Rams in 90 days. Three varieties of PLB were compounded using the conventional molasses and non-conventional sweet potatoes and mango pulps and designated into four treatments; T1, T2, T3 and T4. While T1 was a control group and contained only basal feed with no PLB, T2, T3 and T4 contained basal feeds and molasses, potatoes and mango pulps lick blocks respectively. A total number of 16 rams divided into four were assigned into each treatment. The parameters used for this study were feed intake rate and the cost of compounding the non-conventional lick blocks. The results showed that T2 was more acceptable, recording a higher daily intake of lick block of 110g, followed by T4, then T3 recording 83g and 75g respectively. On the economic aspect, Rams in T2 were found to consume more, recording higher daily expenditure of ₦29.26, followed by T3 then T4, with daily expenditure of ₦15 and ₦10 respectively. This experiment shows that, sweeter ingredients were more palatable than the less sweet ones, hence consumed more. Economically, although protein lick block containing mango pulp was consumed more than that of potatoes, it was found to be cheaper than all the other two protein lick block*

Keywords: Molasses, mango, potato, protein, lick block

Formulation et évaluation des coûts de trois suppléments de blocs à lécher protéinés dans l'État d'Adamawa

Résumé

Les propriétaires de bétail traditionnels ont récemment été découragés d'incorporer les blocs à lécher conventionnels disponibles sur le marché aux régimes alimentaires du bétail. Cela est dû à son coût élevé, qui le rend inabordable pour la majorité des petits agriculteurs. Ces agriculteurs ignorent que les blocs à lécher peuvent être formulés avec les ressources locales non conventionnelles. Cette expérience a été menée pour remplacer la mélasse conventionnelle par des ressources locales non conventionnelles, évaluer le coût de la composition de différents blocs protéiques à lécher (BPL) et déterminer leur acceptabilité parYankasa Rams en 90 jours. Trois variétés de BPL ont été composées en utilisant la mélasse conventionnelle et les patates douces non conventionnelles et les pulpes de mangue et désignées en quatre traitements ; T1, T2, T3 et T4. Alors que T1 était un groupe témoin et *ne contenait que des aliments de base sans BPL, T2, T3 et T4 contenaient respectivement des aliments de base et des blocs à lécher de mélasse, de pommes de terre et de pulpe de mangue. Un nombre total de 16 béliers divisés en quatre ont été affectés à chaque traitement. Les paramètres utilisés pour cette étude étaient le taux d'ingestion d'aliments et le coût de préparation des blocs à lécher non conventionnels. Les résultats ont montré que T2 était plus acceptable, enregistrant une consommation quotidienne plus élevée de blocs à lécher de 110g, suivi de T4, puis T3 enregistrant respectivement 83g et 75g. Sur le plan économique, les Béliers de T2 consomment plus, enregistrant des dépenses quotidiennes plus élevées de ₦29,26, suivis de T3 puis de T4, avec des dépenses quotidiennes de ₦15 et ₦10 respectivement. Cette expérience montre que les ingrédients plus sucrés étaient plus agréables au goût que les moins sucrés, donc consommés plus. Sur le plan économique, bien que le bloc à lécher protéiné contenant de la pulpe de mangue ait été consommé plus que celui des pommes de terre, il s'est avéré moins cher que tous les deux autres blocs à lécher protéinés.*

Mots-clés : Mélasse, mangue, pomme de terre, protéine, bloc à lécher

Introduction

Urea is a good and cheap source of nitrogen for ruminants. However, it can be fatal when consumed in excess. In order to safely provide and supplement urea, several methods have been tried. Ranchers all over the world have for decades successfully used molasses-urea liquid mixtures given in troughs (Beames, 1963). However, there are several limitations to be prevailed while using liquid molasses at farm level; transport, requiring costly tanker trucks; storage in fixed tanks; difficult management of a highly viscous liquid, and distribution, needing troughs or other vessels (Sansoucy, 1986). Mixing urea with drinking water is another solution, but it is difficult and dangerous under small-scale farm conditions. Sprinkling of urea solution on feedstuffs before feeding or urea-ammonization of crop residues were once adopted, but have always been linked to increased risks of urea toxicity and problem of handling, distribution and storage of the treated residues of crops (Gupta *et al*., 1986). Other techniques have solved the above problems, particularly by "solidifying" the urea and molasses. The solid form presents many advantages as it makes transport, storage and distribution easier and reduces risks of toxicity. The use of blocks has been reported since 1930s (Ben Salem *et al*., 2007). The first systematic trial on the use of blocks was conducted in South Africa in 1960 (Hassoun and Ba, 1990), although during the early periods, only urea and salts were used in compounding the blocks. In the recent years, some additions in the blocks have been the incorporation of unconventional by-products such as beans (*Vigna unguiculata*), cassava (*Manihot esculenta*) and garlic (*Allium sativum*),which have increased the consumption of roughages (Ben Salem *et al*., 2007). The replacement of molasses in blocks by wasted or local resource is also needed to reduce the cost of the blocks. In many cases, molasses is not always readily available or is either difficult to handle or too unaffordable by the traditional livestock farmers. This attempted to manufacture protein lick blocks without molasses. Molasses is always preferable because it makes blocks compounding easier, enhances the palatability and supply of useful elements such as sulphur. In this study however, wasted mangoes and sweet potatoes were used as alternatives to molasses, which are easily accessible to livestock owners in various areas in Adamawa State.

Materials and methods

Location of the study area

The study was conducted at ModibboAdama University (MAU), Yola, Adamawa State, North East of Nigeria. Adamawa has 21 Local Governments Areas, with the state capital at Yola. The state occupies 36,917 kilometres square, located at Longitude $12^0$30' 0.00" E and Latitude $9^0$20'00" 'N. The tropical climate of the state is marked by dry and rainy seasons with a temperature range of 16^0C to 40^0C between April and December or January. The major occupation of the people in Adamawa is farming.

Experimental design and management

Three basic raw materials and ingredients were used in compounding the protein lick blocks using locally available agro-industrial by-products in Adamawa state. The effects of feeding each variety of protein lick block supplement on body weight gain, feed intake and protein lick block intake on Yankasa rams in Adamawa state were assessed. The following materials and ingredients were used in compounding the following protein lick blocks: Molasses protein lick block, Mangoes protein lick block and Potatoes protein lick block.

Molasses - it is the syrup left after sugar had been crystallized from a mash of cane in water.It is sweet and palatable, and contains abundant trace minerals, and served as a major source of readily fermentable energy to ruminants. It is dark brown, viscous and sticky in nature. It encouraged stock to lick the block.

Clay- (Fine and smooth texture of soil) was used as a filler, nutrients carrier and anti-nutrients binder.

Fish meal (offal) - served as a source of animal "by-pass" protein.

Soya beans waste - wasted shaft obtained after processing of soya bean cake (awara cake). It served as "by-pass" protein.

Sweet potatoes - served as appetizer (sweetener), filler, binder, and also as asource of vitamin A and C, potassium, antioxidant (Beta-carotene) to substitute molasses in the lick block.

Common salt–served asthe source of Sodium and Chloride. It also acted aspreservative, attractant and limiter (Salt restricts free intake of the block)

Urea fertilizer - served as a source of non-protein nitrogen which ruminants can convert to usable protein.

Mango fruits (Rotten) - it replaced molasses as sweetener, attractant and appetizer. Also, as a source of vitamins, minerals and ant- oxidants.

Egg shells -served as filler, source of Calcium and Phosphorous.

Maize flour- served as source of energy and other trace minerals,

Maize bran- acted as fillers and source of energy.

Equipment- the equipment includeshovel, bucket, open container (half drum), metal mould block, mat and stirring stick.

Procedure for compounding of molasses protein lick block

The processes for compounding these protein block licks followed the procedure designed by Chen *et al.* (1993)The ingredients and proportion used in compounding the protein lick block supplement were presented as follows: Molasses 30kg, Urea 10kg, Common salt 7kg, Fish meal (offal) 8kg, Soya beans waste 10kg, Crushed egg shell 5kg, Clay 15kg, Maize flour 5kg and Maize bran10kg.

Step one

10kg of urea and 7kg of common salt were added into 5 litres of hot water and were stirred thoroughly with stirring stick till the urea and the salt dissolved completely in the hot water and the mixture was added to 30kg of molasses in an open container and were stirred thoroughly.

Step two

The mixture was added on the dry ingredients (clay, maize flour, maize bran, soya bean waste, fish meal, and crushed egg shells) on a concrete floor and were mixed thoroughly with a shovel until the mixture was homogenous.

Step three

A fabricated rectangular steel mould of 24cm by 12cm by 15 cm was used to mould twoblocks of 5kg each at a time. When the resulting paste was ready for moulding, the metal mould was coated with some vegetable oil for easy removal of the blocks.

Step four

The paste was loaded using shovel to fill in the twochambers of steel mould box and was covered with a thick metal sheet tightly fitting the frame and was pressed for 20-30 seconds using hand pressure.

Step five

The metal cover was then removed, the protein lick blocks were removed by lifting the metal box and pushing the protein lick block gently. The protein lick blocks were sundried for sevendays and packed for feeding, and the remaining were kept in polythene bags for storage.

Step six

The metal mould was lightly washed before it was reassembled for the next batch of the blocks. The moulding room was well ventilated and protected from the sun, rain and free from vermin.

Procedure for making potatoes protein lick block.

The ingredients and proportion used in compounding the protein lick block supplement were presented as follows; Sweet Potatoes 30kg, Urea 10kg, Common salt 7kg, Fish meal (offal) 8kg, soyabeans waste 10kg, crushed egg shell 5kg, Clay 15kg, maize flour 5kg andmaize bran 10kg.

Step one

30kg of sweet potatoes were chopped and cooked with about 10 litres of water for 50 minutes in a medium container. 10kg of urea and 7kg of salt were added to the hot potatoes and were stirred thoroughly till urea and salt dissolved completely in the cooked potatoes porridge.

Step two - Step Six were followed as described in the procedure for compounding of molasses protein lick block above.

Experiment to evaluate the intake of compounded protein lick blocks by Yankasa rams

The study was carried out within 90 days with a total number of 16 Rams, averaging 35kg body weight per Ram. In order to assess the intake of three varieties of the protein lick blocks compounded on the experimental rams, all the 16 experimental Rams were randomly placed into four treatments; **T1, T2, T3** and **T4**, and were maintained under similar environmental and management conditions. After fifteen days of acclimatization, the initial weight of each Ram was taken and recorded using flat weighing scale 2012 model. The Rams in T1 served as the control group and were given a known quantity of groundnut straw and bean husks freely. Rams in T2 were also given the same quantity of basal feed with 5kg of Molasses Protein Lick block freely. The T3 were given the known quantity of basal diets as in T1 and T2 with 5kg of Potatoes Protein Lick block. T4 were also given the same quantity of basal feeds of groundnut straw and beans husks and supplemented with Mangoes Protein Lick block. Feeding of protein lick blocks were done by presenting the protein lick blocks directly to the Rams in a box and the animals had only limited access to one surface of the block.

To evaluate the protein lick intake

The weight of the lick block was measured and the present weight was subtracted from the initial weight, daily.

Data generated

All statistical data generated were analysed using the SPSS software version 13.0. Differences between treatment means were separated using the Least Significant Difference (LSD) procedures at 5% Significance level ($P < 0.05$).

Table 1: Comparative assessment of the three protein lick blocks intake on Yankasa rams

Performance	Control group	PLB with Molasses	PLB with Sweet potato (T3)	PLB with Mango (T4)	SEM
Total Protein Block Lick Supplement Intake per Ram in 90 days (Kg)	0^{c}	9.90^{a}	6.75^{b}	7.47^{b}	0.37*
Weekly Protein block lick supplement intake (Kg)	0^{c}	0.77^{a}	0.53^{b}	0.58^{b}	0.031*
Daily Protein block lick Supplement intake (Kg)	0^{c}	0.11^{a}	0.075^{b}	0.083^{b}	0.004*

Keys:
abc = within the same row bearing different superscript
* = Significant (p<0.05)
SEM = Standard Error of Mean

Table 2: Cost and benefits of protein lick block

Cost	Control group (T1)	PLB with Molasses (T2)	PLB with Sweet potato (T3)	PLB with mango (T4)	SEM
Total cost price of Protein block lick consumed per Ram in 90 days (–)	0^{d}	2633.40^{a}	1350.00^{b}	900.00^{c}	80***
Weekly cost price of protein block lick consumed per Ram (–)	0	204.82	105.00	70.00	6.66***
Daily Cost Price of Protein block lick consumed per Ram (–)	0	29.26	15.00	10.00	0.88***
Cost Price of each Kilogram of Protein lick block (–)	0	266.00	200.00	120.00	-

Keys:
abc = within the same row, bearing different superscript, differ significantly
*** = Significant (p<0.001)
NS = Not Significant (p>0.05)
SEM = Standard Error of Mean

Result and discussion

All the experimental animals that offered the protein lick block supplements accepted them readily. The daily average protein lick block consumption by each animal was calculated to be 110g of molasses lick block per ram per day inT2, 75g of potatoes lick block per ram per day in T3, and 83g of mangoes protein lick block per day in T4. The acceptability of Molasses Protein Lick block is significant (p<0.05) compared to that of Potatoes Protein Lick block as presented in Table 2. The results were similar to that of Liu *et al*. (1995) who reported that the daily consumption of urea molasses lick block supplement per animal per day was between 60g to 125g for sheep and goat. It also conforms with the findings of (Bowman, 997) who reported that the target intake of urea molasses lick block was l00g per head per day in sheep. The use of unconventional sweeteners (mango pulp and sweet potato) in this present study did not greatly affect the intake of the protein lick block**.** On onset of the rainy season, there were slight changes in the texture of the three lick blocks probably due to high humidity. This corresponds to the report of Malik *et al*. (1993) who also observed some changes and suggested enfolding the blocks in polythene bags to avoid absorption of moisture and contamination, especially during the rainy season.

On cost evaluation however, the studies revealed that 110g (0.11kg) of molasses lick block consumed per ram per day cost –29.26, 75g (0.075kg) of potatoes lick block consumed per ram per day cost –15.00, 83g (0.083kg) of mangoes lick block consumed per ram per day cost –10.00. The result in Table 2, indicated that the cost of producing one kilogram of protein lick block in each treatment are as follows; Molasses lick block cost –266.00 per kilogram, potatoes lick block in T3, cost –200.00 per kilogram and mangoes lick block in T4, cost –120.48 per kilogram. These results indicate the reduction in the cost of potatoes lick block and mangoes lick block gives additional income per ram per day.

Conclusion

From the studies, it was shown that high cost of molasses lick block can be replaced by sweet potatoes lick block or mangoes lick block without any adverse effect on daily intake. The use of agro-industrial by-products in this experiment has successfully served as highly cost-effective sources of sweeteners, sources of vitamins and as vehicles for supplying other supplements and nutrients. It is also recommended that sweet potatoes (*Ipomoea batatas*) or waste mango pulp (*Magnifera indica*) can comfortably replace the use of molasses in compounding the protein lick block. There is a significant difference ($p<0.001$) in the cost of producing one kilogram of molasses lick block (–270) with that of mangoes lick block (–120) or potatoes lick block which cost (–200).

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