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PRODUCTION AND CHEMICAL EVALUATION OF GRASS-LEGUME BASED MULTI-NUTRIENT BLOCK

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ABSTRACT

This study was conducted to develop and evaluate multi-nutrient blocks (MNBs) as a cost-effective feed supplement for ruminants in semi-arid regions, particularly during the dry season. The objectives were to formulate MNBs using a combination of grasses, legumes, and agro-industrial by-products, assess their hardness and compactness, and analyze their chemical composition. The methodology involved sourcing feed ingredients such as maize bran, groundnut haulms, and grasses (Gamba grass Andropogon gayanus, Napier grass Cenchurus purpureus, Para grass Brachiaria mutica, and Legumes Lab Lab Lablab purpureus, Macuna Macuna pruriens, Stylosenthes guianensis) which were dried separately for 3 days under a shade, processed (the dry leaves were crumbled by hand to form leave meal) and combined with additives like molasses, salt, and urea. The blocks were molded using a cold process and dried for 14 days and analysed for nutritional quality using (AOAC, 1990) method. The study concluded that MNBs are a viable and affordable nutritional supplement for livestock, particularly in areas with limited feed availability. It highlighted the need for optimizing ingredient proportions, improving drying techniques, and ensuring consistency in production to enhance the nutritional quality and shelf life of the blocks.

DESCRIPTION OF PROBLEM

Among the multifaceted interacting factors that affect livestock production is feed resource. Available feed resources during dry season are crop residues and dry grasses used for feeding ruminants (1). However, crop residues and dry grasses are generally low in nutrient contents and digestibility as well as poor in level of voluntary consumption by ruminant animals (2). Most residues are deficient in fermentable energy, protein and minerals. And similarly, supplementation with conventional protein-based feeds to ameliorate the problem is not within the reach of the small holder farmers. The use of agro- industrial by-products by livestock farmers especially in Nigeria is associated with high cost (3).Norton (4) stated that these plants have been incorporated into concentrates as substitute for more expensive processed protein source; such as groundnut haulm (5). Grass and legumes are available in the semi- arid region like Borno State and they have low anti-nutritional factors. Use of feed additive such as molasses as a binder in formulation of multi nutrient blocks is encouraged by many Scientists (6). However, use of molasses is expensive compared to locust bean pulp as binder (7). In order to develop affordable and sustainable supplementation packages to improve the productivity of small holder farmers, the strategy of producing, formulating, developing and use of multi-nutrient blocks (MNB) as conventional feed resources has been proposed by the International Atomic Energy Agency (IAEA) (8). Multi-nutrient blocks (MNB) are now gaining acceptance in all part of the world by pastoralists as well as small holder farmers (9). The technique consists of mixing the required ingredients in a container and pouring the mixture into moulds and leaving to solidify into blocks (10). Feeding of the blocks is convenient and inexpensive method of providing array of nutrients required by both the rumen

microbes and animals, which may be deficient in the normal diet (11). Therefore, the objective of the study is to formulate multi nutrient block using grass legume mixture.

METHODOLOGY

Study Site

The study was conducted at the Teaching and Research farm of the department of animal science faculty of agriculture university of Maiduguri, Borno State

Sources of feed ingredients and preparation

The feed ingredients used for this study were Maize bran, Sorghum Stover, Groundnut haulms, parkia *Biglobosa* pulp, palm oil, Salt, Urea, Bone Meal While the grasses are Gamba grass *Andropogon gayanus*, Napier grass *Cenchurus purpureus*, Para grass *Brachiaria mutica*, and Legumes Lab Lab *Lablab purpureus*, Macuna *Macuna pruriens* and Stylo Stylosenthes *guianensis*, were collected in the Department of Animal Science Pasture Unit University of Maiduguri. The above-mentioned feed ingredients were used to formulate the multi- nutrient blocks (MNB).

Procedure Block Formulation

Leaves of grass were harvested at blooming stage while legumes were harvested at flowering stage. The leaves was shade dried separately for 3 days. All stalks and roots were removed and discarded. The dried leaves were crumbled by hand to form leaf meal. The mixing of the various experimental forage based multi-nutrient block were done by measuring known quantity (Table 1) of individual forage leaf meal in separate containers. The grass served as energy source while the legume as protein source. Grass and legumes were added and mixed thoroughly and set aside a known quantity of urea and salt were dissolved in 400ml of water after which molasses were added and thoroughly mixed. The resulting mixture (water, salt, Urea molasses and palm oil as binder) were added to the first mixture (Grass and legumes) and stirred thoroughly by pestle. Another 200ml of water were added to the mixture and mixed. Wooden mold were used for in casting the Multi Nutrients Block. Each treatment separate mixture were heavily compressed separately into molds and the block were made on the floor under a roofed open side building. The mould were removed and the blocks were air-dried at room temperature for 4 days until used.50gof each Multi-Nutrient Block were taken separately to the Laboratory for Proximate Analysis according to (12).

Mixing of feed ingredients

The feed ingredients were mixed manually in a 200L drum cut to a height of 50 cm. A batch of 100 kg feed ingredients were mixed in varying proportion in blurder to get a homogeneous mixture as recommended by (8). The mixing were done as described by (13).

Experimental design

Four different mixtures were assigned into five treatments with three replicates per treatment in completely randomize design (CRD). The treatment 1 (control) served as the control and it consist of the maize brand sorghum stover and groundnut haulms as both energy and protein source

Moulding of the blocks

Cold method of production was used, after preparation of a homogeneous mixture. The content was placed in a metallic compacter and press manually using hard object mould in measuring 14 x 7. The inner surface of the wooden mould was werehed cleaned and greased with palm oil, in order to facilitate removal of the mouded multi- nutrient blocks easily.

Drying of Blocks

After moulding, the blocks were arranged and allowed to air dry in an open space under shade. A dry environment was maintained for proper and quick drying of the blocks.

Block assessment

The blocks were taken to Civil Engineering Laboratory of University of Maiduguri for Hardness and Compactness evaluation using Concrete Crusher Manufactured by Seidner Riedlingen West Germany.

Physical Properties of the Multi-Nutrient Block

The hardness and compactness of the molded blocks were measured by three independent scores (comprising adult males between the ages

of 30–45 years), according to the method of Hassoun (14). Hardness was assessed by pressing with the thumb in the middle of the block. The block was characterized as soft (*), medium (**), or good (***) when the thumb penetrated easily, very little, or only with greater pressure, respectively.

The compactness was assessed by trying to break the block by hand. A block was characterized as null (+), medium (++), fairly good (+++), or good (++++) when it was broken easily, with difficulty, or with great effort, respectively (15).

Table 1: Composition (%) of Feed Ingredients used for the Multi- Nutrient Blocks (MNB)

Ingredient%	$T_{1(control}$	T_2	T_3	T_4
Maize bran	10	10	10	10
Lab Lab leaf meal	36	-	-	-
Macuna leaf meal	-	36	-	-
Locust bean pulp	5	5	5	5
Stylosenthes leaf meal -	36	-		
Gamba grass leaf meal	40	-	-	-
Napier grass leaf meal	-	40	-	-
Brachiaria grass leaf meal	-	-	40	-
Sorghum stover	-	-	-	40
Groundnut haulms	-	-	-	36
Palm oil	0.5	0.5	0.5	0.5
Bone meal	1.5	1.5	1.5	1.5
Salt	1	1	1	1
Urea	1	1	1	1
Molasses	5	5	5	5
Total	100.00	100.00	100.00	100.00

RESULTS AND DISCUSSION

Physical Assessment of the Multi-Nutrient Blocks

The physical assessment of the multi-nutrient block is presented in Table 2. Hardness and compactness of the block recorded were very good in all the formulated blocks. The color of all blocks was brown. The different formulations had a fine texture and a sweet aroma. The hardness was () and the compactness (++) of the blocks in all the treatments were good, and thus the result of the physical characteristic of formulated multi-nutrient block for this study is similar to the results of Andy *et al*. (2024) who reported () good hardness and (++) compactness for physico-chemical properties of African Black Plum multi-nutrient block. Similarly, the result of this study agrees with the study of (16), who disclosed optimal hardness and compactness of blocks indicate the ingredients were held together reasonably well by the Parkia pulp binder, and thus, will ensure the gradual release of the urea component.

Proximate Composition of the Experimental Multi-Nutrient Block

The result of the proximate composition of the experimental Multi-Nutrient block for this study is presented in table 2. The result shows that all nutrient were significant ($p<0.05$) except non-fiber carbohydrate (NFC). The dry matter (DM) content were highest in treatment 2 with 89.00% while the lowest at treatment 3 with 63.67%, likewise crude

protein (CP) having maximum of 30.67% at treatment 3 and the minimum is obtained at treatment 2 with (7.00%). Equally crude fiber has the uppermost value of 5.50% at treatment 2 and the least value is treatment 3 (2.00%) and treatment 4 (2.00%) respectively. However, Ash has highest value of (45.00%) at T4 and least value (17.50%) at T2. meanwhile EE, have greater value of (12.90%) at T2 and lesser value of (9.20%) at T3. Similar nitrogen free extract is obtained with the high value of (1.90%) in T3 and T4 and the low value noted at treatment 3 with (1.20%).

Table 2-The composition of the experiment of Multi-nutrient Block

Parameters	T1 S. stover G/nut	T2 Gmaba/Lablab	T3 Napier/ Mucuna	T4 Bracharia/Stylosanthes	SEM
DM	87.67^{b}	89.00^{a}	63.67^{c}	88.33^{b}	0.64
CM	30.67^{a}	7.00^{c}	8.00^{b}	8.00^{b}	0.54
CP	8.00^{b}	7.00^{b}	30.67^{a}	8.00^{b}	0.53
CF	3.50^{b}	5.50^{a}	2.00^{c}	2.00^{c}	0.74
ASH	24.80^{c}	17.50^{b}	43.16^{b}	45.00^{a}	0.01
EE	10.37^{b}	12.90^{a}	9.20^{c}	9.90^{b}	0.25
NFE	1.20^{c}	1.50^{b}	1.90^{a}	1.90^{a}	0.01
NFC	1.00*	1.00*	1.00*	1.00*	0.74NS

a, b, c Means in the same row with different superscript are significantly ($p<0.05$) difference
NS= Not significantly ($P>0.05$) difference, SEM= Standard error of mean, *= Significant difference ($P<0.05$), Dry matter Dm, Moisture Content MC, Crude Protein CP, Crude Fiber CF, Ash, Ether Extract Ee, Non-Fiber Carbohydrate NFC, nitrogen free extract NFE.

Conclusion and Application

The study on the formulation of multi-nutrient blocks (MNBs) for livestock has provided valuable insights into the potential of these blocks to improve livestock nutrition, especially during the dry season. Additionally, the study emphasizes the importance of considering local agricultural practices and the economic constraints of smallholder farmers when formulating multi-nutrient blocks.

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