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Research article

MULTI-NUTRIENT BLOCK FORMULATIONS AND PRODUCTION IN THE SEMI-ARID ENVIRONMENT

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Abstract

A study on the formulation and production of multi-nutrient blocks for feeding ruminants using local feed ingredients was conducted at the university of Maiduguri Teaching and research farm of the Department of Animal science, university of Maiduguri, in November 2006. Five formulations (F1,F2, F3, F4, and F5) were developed. The feed ingredients used include maize bran, cotton seed cake, cement, molasses, potash and salt. The proximate composition of the formulations were analyzed in laboratory which gave the dry matter for f1, f2, f3, f4, and f5 as 56.35%, 62.3% 53.5%, 63.2% and 6.6 respectively. The crude protein ranged from 19.4%, 24.4%23.1%, 24.7% and 26.7% and 26.3% 53.5%, 63.2% and 60.6 respectively. The crude protein ranged from 19.4%, 24.4%, 23.1%, 24.7% and 26% 53.5%, 63.2% and 60.6 respectively. The crude protein ranged from 19.4%, 24.4%, 23.1%, 24.7% and 26.9% crude fibre also ranged from 24.0%, 23.5%,24.0%, 16.5% and 18.0% respectively. The values for ash were 4.5%, 5.5%, 6.0%, 6.0% and 6.0% respectively. The cost effectiveness of 20kg mixture producing 12 blocks which ranged from 744.2 N750.8, N750.8, N750.8 and N860.3 respectively. The average cost for each blocks N62 to N71.7 which is highly affordable by local farmers as supplement for dry season feed so as to meet their nutritive requirement.

Keywords: riminants; multinutrient; formulation; production; semi-arid

Introduction

Ruminant diets in most developing countries are based on crop residues. These feeds are imbalanced and particularly deficient in energy, Protein, minerals and vitamins. They are highly Lignified, their digestibility is low this characteristics keep intake and productivity low [1].

The principles for improving the use of these poor quality roughages by ruminants include supplementation of fermentable nitrogen and minerals which could by- pass the rumen and this could be inform of multi-nutrients block formulated. These blocks should contains multi-nutrients that by-pass rumen and such materials include maize bran, cotton/seed, cake, salt, potash cement molasses and area. [2]; [3]: [5]. The block could be made from a variety of component feed ingredients depending on their availability locally, nutritive value, price, existing facilities for their use and their influence on the quality of blocks in order to manipulate the rumen function.

This technologies is appropriate to small holder who do not have easy access to extension service.

In order to develop affordable and sustainable supplementation packages to improve the productivity of small holder farms, at strategy of producing multination block (MNB) has been proposed by the international Atomic energy Agency (IAEC) [7].

Natural pasture, crop residues, animal waste and to a lesser extent agro industrial by- products, are the most readily available low-cost feeds for ruminants in Nigeria [8]. Crop residues grazing by pastoralist cattle have been reported to account for a large proportion of total grazing in the dry season [9]; [10]. In the absence of high quality forage in the dry season, these feeds will remain the main feed resource for the smallholder farms in most developing countries.

Attempt to upgrade low quality roughage by chemical or physical methods as well as supplementation has not found wide acceptance by livestock farmers because it is expensive and uneconomical [4]. Such a situation could explain the wide growing trend to identify alternative low cost feeds high in energy and protein and to explore possibilities of including them in ruminant chits [11]. The most critical nutrients are considered to be fermentable nature and carbohydrate precursors needed by the rumen microbes [19]. The nutrients requirement to support high level of production in animals can be obtained in the choice of agro industrial residue the need is to develop a clearer and readily available Multi-nutrient supplement rich in source of fermentable carbohydrate, nitrogen, minerals [12].

In Africa, grazing usually on communal lands is the dominant feeding system and nutritive value is not a constraint when there is rain but during the extended dry season the mature tropical grasses (standing hay) resemble crop residues in their chemical composition and nutritive value. The principle underlying the efficient use of fibrous crop residues and standing hays by large ruminants are now well understood. The first constraint to their better utilization is the imbalance in the nutrients made available from rumen fermentative digestion and not their low digestibility [14]; [15].

As a result of scarcity and high cost. Of molasses in many countries, MNB without molasses was promoted by the food and Agricultural organization of the United Nations in different parts of the world [16]. Despite promise results from MNB in many courtiers, the technology is yet full adopted in Nigeria.

The major feed resources for large ruminate in developing countries tend to be low in nitrogen and of low digestibility. Crop residues are the staple feed a year round, supplemented to a varying degree by grazing and or harvested grasses, weeds and free foliage.

OBJECTIVES

1. The aim of this study is to formulate and produce multination blocks for feeding ruminants using local feeds ingredients.
2. Determine the nutritive valve of the formulations.
3. To estimate cost effectiveness of multi-nutrients blocks using local feed ingredients.
4. To determine hardness, compactness and dryness of the formulations.

MATERIALS AND METHODS

Experimentation Site/Location

The experiment was carried out at the University of Maiduguri, Teaching Research livestock form. The area situated on latitude 1151 north. Longitude 30 05' east and at altitude of 354m above sea level. It falls within the Sahelian-region (semi-arid Zone) of west Africa, which is characterized by short duration of 3-4 mouths at rainfall. Rainfall varies from 300-500mm, ambient temperatures are highest by April and May and is in the range of 35-40^{0}c while relative humidity ranges from 45-50% [17].

Five (5) formulations will be carried out as shown in the table below:

Table 1: Formulations

Ingredients	**composition (%)**				
	F1	**F2**	**F3**	**F4**	**F5**
Maize bran	9.1	7.9	8.2	9.0	82
cotton seed cake	5	5.2	4.1	4.1	3.3
area	1.4	1.4	1.4	1.4	1.4
Molasses	1.0	1.0	1.0	1.0	1.6
Cement	1.6	2.5	2.5	1	1
Salt	1	1	1	1	1
Potash	20kg	20kg	20kg	20kg	20kg

Mixing Of Feed Ingredients

Mixing of the ingredients was done by hand in a 200 litre drum out to a height of 25cm.Approximately 20kg of ingredients were mixed per batch in order to get a homogenous mixture. The mixing procedure was outlined by [2]. The urea fertilizer was dissolved completely for about 20-30 minutes. The binder was dissolved in another bucket and after being mixed together. And were later all poured into the drum which already contained the dissolved molasses. The whole solution was stirred and mixed properly to obtain a homogenous mixture. Other ingredient was added as follows: the cottonseed cake grounded one, and maize bran. Each ingredients was added only after a homogenous mixture of other ingredients was affirmed.

Molding of Block

The homogenous mixture was placed in a wooden container moulds meaning 15cm x 15 x10cm [18]. The material block was pressed manually using hand. The surface of the wooden mould was covered with polythene sheet to facilitate de-moulding and clearing of the surface. Blocks formed ere removed immediately from the moulds and all blocks were sun dried in the open air under shade.

Block Assessment and Curing

Hardness and compactness of the block were tested four days after de-moulding [16] but was found soft and contained moisture. Second test was made after 10-20 days by three pensions independently by assessing, handiness on the scales; soft, medium and good. Hardness was determined by pressing with the themes in the middle of the block and compactness by the ease to break by hand. Efforts were geared towards obtaining blocks which set well and could be transported without consequent breakage.

Chemical and Cost-Effectiveness Analysis

All feed ingredients used together with samples from moulded blocks produced were chemically analysed for dry matter (Dm). crude protein 9CP). Crude fiber (CF). Ether Extract (EE) Ash and Nitrogen free extract (NFE) using (AOAC,) method. Cost effectiveness of block production for the five formulations was calculated using the current prices of feed ingredients used.

Feeding Multi-Nutrient –Block (Mnb)

The hardness of the block will affect it's intake rate. If it is soft, it may be rapidly consumed with the risk of toxicity. On the other hand, if it is too hand it's intake may be highly limited.
Blocks are introduced gradually in the diet of ruminant during a transition period of about two weeks to enable the animals a dept to the new supplement. Afterwards, blocks are offered to animal without any interruption. Blocks being palatable are licked by animals according to their requirement, there by regulating the intake of urea to ensure it's efficient utilization with out any risk of toxicity [6].

Benefits of Using Multi-Nutrient-Block (MNB)

Consumption of MNB depends on the type of roughage and concentrates in the diet as well as on the physiological state of the animal. According to [19]. There is a significant improvement in body and reproductive performance as well as an overall increase in milk field.

Result and discussion

TABLE 1: multi-nutrient Blocks formulation (%)

Ingredients	Formulations				
	F1	F2	F3	F4	F5
Maize bran	36	38	45	20	5.5
Cotton seedcake	34	31	24	49	14
Urea	7	7	7	7	7
Molasses	9	9	9	9	9
Cement	5	5	5	5	5
Salt	5	5	5	5	5
Potash	5	5	5	5	5
	100	100	100	100	100

Five formulations (F_1, F_2, F_3, F_4, and F_5) were carried out using a variety of locally avail able fed mate sales such as maize bran, cotton seed cake, area, molasses, cement, salt, and potash respectively.
The multi-nutrient blocks in this study had high moisture content which took about 3-4 weeks after formulation before becoming dried with desired compactness and hardness. This is different from what was recorded by [16] who reported on test for hardness of the blocks and compactness for multi-nutrient blocks four days after drying.
The different quantities of water were used in 20kg mixture. The formulation f1, f2, f3, f4 and f5 has 11.5,.13.5,12. 14, and 15.5 lites of water respectively were used which was acceptable in terms of thoroughly mixture, which gave and improve compactness, and there was no sipping of water during moulding when pressure was applied. With amount of water used, it has been found that in f5 there was little sipping of water due to about high liter of water used which also took about 4-5 week before dries up.

TABLE 2: Proximate Analysis of Ingredients

Parameter	Maize bran	CSC	Molasses	Cement	Salt	Area
Dry mater (%)	97.57	94.50	-	-	-	
Crude protein (%)	4.3	17.00	2.90	-	-	
Ether extract (%)	1.2	6.00	-	-	-	
Crude fibre (%)	15.7	14.00	-	-	-	

Nitrogen free extinct (%)	-	52.50	23.10	-	-	
Ash (%)	8.30	5.0	23.10	-	-	
Calcium (%)	-	-	0.82	25.00	-	
Sodium (%)	-	52.50	23.10	-	-	
Chlorine (%)	-	-	-	-	60.66	
Iron (PPM)	-	-	-	21.45	-	
Magnesium (%)	-	-	-	17.9.00	-	
Nitrogen	-	-	-	-	-	**46.00**

The results of the proximate composition of individual ingredient shown above in table 1.
The dry matter content of the ingredient used in the formulation ranged from 94.50 and 97.57 for maize bran and cotton seed cake respectively. The low moisture content of the cotton seed cake is slightly above what was reported by [17] which may be due to the variation in environmental condition. The crude protein % of the cotton seed cake was high with (17.00%) followed by maize bran 4.3% and molasses (2.90%cp). This is lower to that reported by [20] as (15-38%cp). In crude fibre the % ranged from 14.000% and 115.7% in cotton seed cake and maize bran, this is because maize bran has higher crude fibre than cotton seed cake.
The proximate composition of the moulded blocks used as the feed ingredients used together with samples from moulded blocks produced were chemically analyzed for dry matter (DM), crude protein (CP) Ether Extract (EE) and Ash. The proximate composition of individual moulded blocks used in the five formulations are shown in table 3 below:

TABLE 3: Proximate Composition of Formulations

Sample codes	%Dry matter (DM)	% moisture Content (MC)	%Protein	% fat	%fibre	%Ashe
F1	56.35	43.7	19.4	6.5	24.0	6.0
F2	62.3	437.7	24.4	5.5	23.5	6.0
F3	53.5	46.5	23.1	3.5	24.0	6.0
F4	63.2	36.9	24.7	6.0	16.5	4.5
F5	60.0	39.4	26.9	5.0	18.0	5.5

From the analysis, the dry matter content was estimated as in dry matter % it ranges from 53.5 to 63.2 in F3 and f4 respectively the % moisture content is also reasonable which leads to appropriate compactness and it ranges from 36.9 to 46.5 although there was little sipping also in f3 due to high level of water in it but has no negative effect on the blocks. The % protein and fibre % ranges from 22.1 f3 to26.9 in f5 and 16.5 in f4 to 24.0 respectively in f1, and f3, this is because maize bran in the ingredient consist more fibre. The % Ashe ranged from 4.5 to 6.0 respectively.

TABLE 4: Cost Effectiveness of the Formulation Naira (#)

Ingredients;	F1	F2	F3	F4	F5
Maize bran.	1092	948	984	1080	984

CSC	600	624	588	492	396
Urea	448	448	448	448	448
Salt	130	130	130	130	130
Molasses	1100	1100	1100	1100	170
Cement	272	425	425	425	425
Potash	79	79	79.	79	158.5
Total	3721	3754	3754	3754	4301.5

The table above shows the cost effectiveness of the formulations F1 f2, f3, f4 and f5) in which the cost of each ingredient in producing 100kg mixture that gave 12 block In each formulations, which amount to (₦3721) in f1, (3754) in f2, the same in formulation f3 and f4 but in f5, it gave (4301.5) which is higher because reasonable amount of molasses was used at (1.6%) and potash at (2%) which increased the cost of the formulation.
In the cost of each block, f1, cost about sixty two Naira (N62), f2, f3 and f4 cost sixty two Naira six kobo (62.6) and finally f5 cost seventy one Naira seven kobo (71.7) respectively which has high price because of the cost of the formulations.

Conclusion

It is concluded that it is possible to make or produce multi-nutrient lick block (MLB) of good hardness and compactness using a variety of locally available feedstuffs such as maize bran, cotton seed cake, molasses, urea, salt, cement, and potash. The use of small quantity of molasses (9%) was used in formulation one to five which improved the level of binder. Cement at (1%) that was needed to obtain blocks of an acceptable quality in terms of hardness, compactness and can easily be transported.
Four percent salt and five percent potash have been found to be Appropriate which provide multi-nutrient lick blocks (MLB) with required ingredients in terms of fermentable nitrogen's sodium and chloride.
Finally it is concluded that (MLB) made from agricultural by products and animal wastes can be used for replacing conventional supplements such as good quality roughage and concentrates feeds fed to ruminant animals at subsidized rate.

Recommendations

In order to enhance the utilization of multi-nutrient lick blocks (MLB), it is highly recommended for use as a supplement by the ruminant livestock in the semi-arid zone of Nigeria because it reduces the cost of supplementation especially with the use of concentrates that are more expensive and at the same time reduce the pressure on grazing grassland which are generally insufficient to meet the maintenance requirement of the animals for at least some part of the year.
It is also preferred to manufacture multi-nutrient lick blocks (MB) at a time prior to their usage so that they could reach the desired degree of hardness at the time when needed.

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