

Production of Multinutrient Blocks for Ruminant Animals Using Different Types and Levels of Binders in the Sudan Guinea Savanna of Nigeria

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Abstract: This study seeks to formulate and manufacture multinutrient blocks for ruminant animals using different types and levels of binders. The experimental design was laid out in a factorial arrangement consisting of two binders (quick lime and cement) at two levels. Treatment 1 (T1) has 8% quick lime and 4% cement while treatment 2 (T2) has 4% quick lime and 8% cement. Results revealed that the chemical composition of a multi nutrient block showed dry matter content was found to be (68.7%) and (66.3%) for T1 and T2, respectively. The contents for CP (17 - 17.6%), CF (12.8-13%) and NFE (61 %) were obtained. Most of the blocks were of medium compactness and hardness. T1 produced a higher strength than T2 combination but is not consistent. The cost of T1 for 14 blocks (50kg) was the highest (N5, 551) while T2 (N5, 539) record the lowest. The average cost of each block was estimated as (N48/ 4kg of block) which is highly affordable by the smallholder farmer in the semi-arid environment. In conclusion, the study revealed that quick lime in the first formulation (T1) combination can replace cement as most animal welfare advocates are against the usage of cement in animal feed preparation. Also, the higher strength and compactness at cost effective rate in the first formulation (T1), provides the fermentable nitrogen required by the ruminants kept by farmers in the Sudan Guinea Savanna of Nigeria.

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1. Introduction

In many areas of tropical Africa, ruminant livestock production has long been of major importance to the rural population (Pamo *et al.*, 2002). It has served many purposes in the direct production of food, providing traction for transportation and land preparation, as a cash reserve for emergency investments and long term saving, and in the fulfillment of social obligations, customary rites and religious purposes (Pamo *et al.*, 2002; Odeyinka and Ajayi, 2004; Chiejina and Behnke, 2011). One of the major problems confronting ruminant producers in many tropical countries is, feed availability and quality due to long dry and short rainy seasons whose consequences leads to weight loss, low birth weight, lowered resistance to disease and reduced animal performance (Fajemisin *et al.*, 2010). During the dry season, quality of the range plants decline with maturity below the critical level of 6 - 8 % needed to maintain an efficient rumen function (Van Soest, 1991). The lowered quality, coupled with a simultaneous reduced availability, results in lowered productivity across all their productive stages (Bamikole and Babayemi, 2004).

This therefore, calls for a reasonable level of feed supplementation, with agro-industrial by-products which are cheap and can supply substantial amounts of livestock energy, protein and mineral needs to promotes the efficiency of rumen microbial growth and supplies the animals with sufficient by-pass nutrients to balance nutrient availability and nutrient demand (Preston and Leng, 1987; Leng *et al.*, 1991; Aletor *et al.*, 2010). A means of presenting these feed sources is multi-nutrient blocks which will upgrade the energy and ammonia levels in the rumen (Mancini *et al.*, 1997).

The components of multi-nutrient blocks are urea, poultry litter for fermentable nitrogen, molasses for fermentable energy, wheat bran and cement (Hadjipanayiotou, *et al.*, 1993). The use cement and molasses as binders ensures the slow release of the otherwise toxic molasses and urea (Onwuka, 1997). Multinutrient block is an excellent way of providing readily degradable protein and readily fermentable energy to ruminant animals and can increase digestibility and feed intake of fibrous feeds by up to 20% and 25 - 30%, respectively.

In the present study we investigate ways to formulate and manufacture multinutrient blocks using

locally available feed resources at different levels of binders (cement and quicklime) inclusions and evaluate the hardness and compactness, chemical composition and cost benefit of the multinutrient blocks supplement.

2. Material and Methods

The experiment was conducted at the Department of Animal Health and Production Technology, Federal College of Agricultural Produce Technology, Kano state Nigeria located on latitude 12°20'N and longitude 8° 31' E. (G.P.S., 2012). The mean annual rainfall and temperature were 600mm and 38 - 41° respectively (KNARDA, 2012). Feed ingredients like Salt, fertilizer, quicklime, urea and cement were purchase as a mixture already prepared by a chemical company.

The experimental design was laid out in a factorial arrangement consisting of two binders (quick lime and cement) at two levels. Treatment 1 has 8% quick lime and 4% cement while treatment 2 has 4% quick lime and 8% cement. All the ingredients were separately weight according to the formulation and place into different sacs. Mixing of ingredients was done manually.

Table 1: Multinutrient block formulations with two levels of binders inclusion.

Ingredients (%)	Treatments (T)	
	1	2
Quicklime	8	4
Cement	4	8
Molasses	20	20
Urea	10	10
Soya bean meal	20	20
Wheat bran	30	30
Salt	5	5
Bone meal	3	3
Total	100	100

The molasses was poured into a plastic container, the urea was dissolve in water followed by salt, which was dissolve separately and allow to completely dissolved for about 20 – 30 minutes. The binders (cement and quicklime) with bone meal were mix in another separate container and after being thorough mixed. The two fore-mentioned separate mixtures were then mixed together in one of the containers. The mixture obtained was poured into the container already containing molasses. The two mixes were then stirred for about 5-10 minutes to ensure homogenous mixture is obtained. The other ingredients were later added one after the other (Mohammed *et al.*, 2006). Finally the soy bean meal and wheat bran were added and mixed thoroughly for

about 20 minutes to ensure uniform mixture is obtained. Then, the complete mixture is poured into a sizable wooden frame planks placed on a smooth concrete floor with slots cut out to enable easy assembly and removal. The planks measurement was 25cm×15cm×10cm, holding urea-molasses block weighing about 4.0-4.5 kg.

Once set the frame can be removed to allow it dry in an open air and turning was done twice in a week to hasten and ensure even drying. The drying period last for about 28 days within which every week the strength of the blocks will be assess using the Hassoun (1989) method. Mechanical testing of the blocks for Hardness (H) and compactness (C) of blocks was measured by three persons independently 7 and 14 days after manufacturing and demoulding following the method of Hassoun (1989). Hardness was assessed by pressing the middle of the block with the thumb. A block was characterized soft (S), medium (M) or good (G) when the thumb penetrated easily, very little or only with greater pressure, respectively. The compactness (C) was assessed by trying to break the block by hand. A block was characterized null (N), medium (M) or good (G) depending how easily it was broken, with difficulty or with great effort, respectively.

The proximate analysis for the samples of the two treatments were analyzed for dry matter (DM), moisture, crude protein, ash and total nitrogen at 28 days after manufacturing of the multi nutrient blocks using the methods of AOAC (1990). Data proximate composition were analysed using Anova by General Linear Model procedure of Statistical Analysis System, version 9 (SAS, 2003). Treatment means were separated using Duncan's Multiple Range Test. The costs of producing the two formulations were calculated using the current prices of feed ingredients in Naira.

3. Result and Discussions

The chemical composition of a multi nutrient block depends on the quantity and the kind of ingredients used in the fabrication. Analyses made on the blocks showed that the composition of the finished blocks was related to that of the individual ingredients even though there is no greater difference between the two treatments. The chemical composition of a block determines its feeding value as a supplement. From Table 2, the dry matter content was found to be (68.7%) and (66.3%) for T1 and T2, respectively. The higher DM values indicate that when fed to animals, they will eat less to obtain their requirement. Moisture in the multi nutrient block might reduce the storage period of the blocks as it will encourage mould growth. However, it may also serve as a source of water to ruminants fed low moisture feed especially

during the dry season. Moisture content of the blocks was much and these were as a result of the season (wet season) of the blocks production that covered August and September in Nigeria. This goes on to reiterate what was reported by Sansoucy *et al.*, (1986) that if dried multi nutrient blocks are needed for feeding they should be fabricated at an earlier date. The crude protein content ranged from (17.2 - 17.6%) CP which is lower to what was reported by Sansoucy *et al.* (1986) (28.5%) CP. Crude fiber ranged from (12.8-13%) while nitrogen free extract obtained was 61.00%.

Table 2: Proximate Analysis of Multinutrient blocks formulations.

Parameters (%)	Treatments (T)		SEM	LOS
	1	2		
Moisture	31.0	33.7	1.7	NS
DM	68.7	66.3	1.3	NS
CP	17.6	17.2	0.5	NS
Ash	15.4	12.6	1.5	NS
CF	13.0	12.8	0.2	NS
NFE	52.0	56.2	2.3	NS

SEM = Standard error of means; DM = Dry matter; CP = Crude protein; CF = Crude fibre; NFE= Nitrogen Free Extract; LOS = Level of significance.

Hardness and compactness of blocks were measured by three persons independently. Most of the blocks were of medium (M) compactness and hardness. The result obtained from this research revealed that T1 produced a higher strength than T2 combination. This is similar to what was reported by Hadjipanayiotou *et al.*, (1993) that increasing the level of quick lime increases the strength of multi nutrient blocks. If they are too soft, there may be risks of toxicity resulting from the high intake of urea. If they are too hard, the intake is too low to have any effect on the animals. This shows that good compression is needed to obtain multi nutrient blocks of good strength despite the role binders' play. T1 combinations of binders gave the blocks good strength. This has the advantage of ensuring gradual release of urea to animals when fed such feed blocks, otherwise, urea toxicity will occur, and also becomes more convenient for packaging, storage, transport and ease of feeding as noted by Sansoucy *et al.* (1986). However, it indicates that quick lime can replace cement as it is more expensive and most animal welfare advocates are against the usage of cement in animal feed preparation. The drying was done under open ventilation to avoid direct sunlight as this might result in a loss of nutrient elements like vitamin C. The blocks did not grow mouldy even when stored after one month of manufacture. This may be attributed to the minimum amount of water used for

fabrication. This emphasizes on the fact that provided minimum amount of water used for multi nutrient block fabrication, blocks can be stored for months (Kunju, 1986). This implies that when fabricated towards the end of the rainy season, they could be used up to the beginning of the next rainy season, where more feed will be available for ruminants. The blocks were of good strength. The consistency observed in the final blocks mixtures was due to the premixing of the cement in water before adding to mixture. This also tends to ensure an even spread of the cement in the feed mixture which facilitates and improves uniform hardening of blocks (Sansoucy *et al.*, 1986). This also ensured that the ingredients were held together reasonably.

Table 3 shows the cost effectiveness of producing 50kg mixture (14 blocks) which was (N5, 551) for T1 and (N5, 539) for T2.

Table 3: Cost effectiveness of producing 50kg mixture (14 multinutrient blocks).

Ingredients (N)	Treatments (T)	
	1	2
Quicklime	192.00	96.00
Cement	84.00	168.00
Molasses	1500.00	1500.00
Urea	1027.80	1027.80
Soya bean meal	1372.50	1372.50
Wheat bran	1050.00	1050.00
Salt	250.00	250.00
Bone meal	75.00	75.00
Total	5,551.00	5,539.00
Cost/Block	396.50	395.60

N = Naira

A unit of 3.5kg block on average costs about N396.0. The cost of T1 is highest (N5, 551) and lowest in T2 (N5, 539). This was due to the high level of quicklime that was used in T1, which has higher cost of purchase as compared to cement. The average cost of each block was estimated as (N 48 per 4kg of block) which is highly affordable by the smallholder farmer in the semi-arid environment.

4. Conclusions

The study revealed that quick lime in the first formulation (T1) combination can replace cement as most animal welfare advocates are against the usage of cement in animal feed preparation. Also, the higher strength and compactness at cost effective rate in the first formulation (T1), provides the fermentable nitrogen required by the ruminants kept by farmers in the Sudan Guinea Savanna of Nigeria.

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