SUBSTITUTES FOR MOLASSES AND CEMENT IN UREA-MOLASSES BLOCKS FOR RUMINANT ANIMALS

C.F.I. ONWUKA AND E.N. OLATUNJI,

Department of Animal Nutrition, University of Agriculture, P.M.B. 2240, Abeokuta, Ogun State, NIGERIA.

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ABSTRACT

The first of two experiments was conducted to substitute cassava starch for molasses at levels of between 0 and 100% in urea-molasses blocks in six treatments. In a second experiment, ground leaves of Gliricidia sepium, Leucaena leucocephala, Gmelina arborea and cement were included at 15% levels respectively as substitutes to cement as feed block binders. A fifth treatment combined cement and the various leaves as binders. Parameters monitored included block hardness, stability in water, colour, storability, nutrient quality and cost. Results obtained showed that the blocks dried within 3 - 7 days and the weights of the blocks progressively decreased (P<0.01) within the drying period. Final block weights were 88 to 97.5% of initial weights. The crude protein contents of the 100% molasses blocks were lower while the fibre contents of the leaves - substituted blocks were higher (P>0.05) but between 25 and 28% CP. The blocks were strong and did not dissolve in water for 3 to 5 days. Increasing levels of cassava starch substitution made the blocks harder. Block colours varied from dark brown to dirty white. Use of leaves as binders reduced cost of the blocks by as much as 20%. Blocks stored better when the sides of the plastic mould were lined with cellophane paper. The cassava substituted blocks stored up to 9 months without moulding. Gliricidia sepium leaves, however, served as a good binder just like the other two leaves types used. The implications of using cassava starch and browse leaves in urea-molasses multi-nutrient blocks are discussed.

KEYWORDS: Molasses, Cement, Cassava, Block, Binder, Browse.

INTRODUCTION

A large expanse of land and forage capable of sustaining the livestock population in Nigeria can be found in its humid and sub-humid zones. However, with weather vageries, the nutrient quality of the leaves usually consumed by ruminant livestock also changes, especially during the 6 month dry season period (Onwuka, 1986; Leng, 1990). The leaves then have high proportions of lignified cell walls with low digestibility and fermentation rates thus depressing forage intake. This is even worse when the crude protein level is below 6% in the leaves. (Combellas, 1991; Minson, 1981). There is therefore the need for supplemental energy and protein to ruminants for improved performance (Leng et al, 1991; Aarts et al, 1990; Ali and Mirza, 1986; Kunju, 1986). The cattle fattening programme by National Livestock Projects Department, in Nigeria, NLPD, (1992) recommended the use of liquid molasses which had problems of availability and method of utilization at the farm level. cassava starch, a polysaccharide by-product of cassava, is capable of supplying energy to ruminant livestock. Forage species produce leaves which contain useful nutrients. Leaves of

Gliricidia sepium; Leucaena leucocephala; Manihot esculenta; Erythrina senegalensis; and some other leguminous forage with long fibre can serve as binders (Preston, 1990) and thus reduce the need for cement in urea- molasses blocks. The experiments reported here were therefore designed to test the potentials of cassava starch and leaves of forage legumes as substitutes to molasses and cement respectively in Urea-Molasses Multinutrient blocks.

MATERIALS AND METHODS

ABLE 1: SUBSTITUTION OF CASSAVA STARCH FOR MOLASSES IN UREA - MOLASSES BLOCKS (g / 100g DM)

Level of Substitution	TREATMENTS					
CONSTITUENTS	0 A	20 B	40 C	60 D	80 E	100 F
Molasses	50	40	30	20	10	0
Cassava Starch	0	10	20	30	40	50
Urea	10	10	10	10	10	10
Elemental Sulphur	0.2	0.2	0.2	0.2	0.2	0.2
Salt	5.0	5.0	5.0	5.0	5.0	5.0
Cement	10	10	10	10	10	10
Gmelina sp. leaves	5	5	5	5	5	5
Rice Bran	19.8	19.8	19.8	19.8	19.8	19.8
Total	100	100	100	100	100	100

Cassava Starch Collection

In the processing of cassava tubers into "Gari", (a local carbohydrate foodstuff in Nigeria), the ground tuber is bagged and expressed under pressure. Cassava starch is recovered as a suspension in the exudate. This is dried and can be made into powder by simple grinding. On a small scale, a mortar can be used to pound the starch moulds into powder and this can

TABLE 2: COMPOSITION OF VARIOUS UREA-MOLASSES BLOCKS MADE WITH DIFFERENT LEAVES AS BINDERS (g/100g DM)

	TREATMENTS				
Constituents	1	2	3	4	5
Molasses	50	50	50	50	50
Urea	10	10	10	10	10
Salt	5	5	5	5	5
Elemental Sulphur	0.2	0.2	0.2	0.2	0.2
Cement	15	-	-	-	3
Gliricidia sp. leaves	-	15	-	-	4
Leucaena sp. leaves	-	-	15	-	4
Gmelina sp. leaves	-	-	-	15	4
Wheat Bran	19.8	19.8	19.8	19.8	19.8
Total	100	100	100	100	100

be evenly distributed in the blocks.

Processing of the browse leaves

Young leaves of Gliricidia sepium; Leucaena leucocephala and Gmelina arborea trees were cut and sun-dried for 4 days. The brittle, dried leaves were then squeezed/crushed into tiny crumbs of leaf meals.

Moulding of the Blocks

The methods of Sansoucy (1986) and Mwendia and Khasatsili (1990) were used with slight modification. Plastic moulds measuring 15cm X 12cm X 6cm (1,080cm^3) were used. A strict order of block making and moulding was followed. Cement was pre-wetted with water. Molasses was weighed first while other ingredients were added by sprinkling thinly and uniformly over Molasses in the proportions and order they have been listed in Tables 1 and 2. Blocks were made in triplicate for each treatment in a completely randomized design. The ingredients were then mixed and stirred properly for homogeneity. The pastes obtained from these mixtures were put in labelled plastic moulds lined with cellophane paper. They were then sun dried for 7 days during which they were protected from the rain.

Data Collection and Analyses

The blocks were monitored and data collected on drying time, weight of blocks, colour, consistency, solubility, storability of the blocks and proximate analyses. Proximate analyses were done with the methods of AOAC (1984). The data were tested for significance and the means seperated (Steele and Torrie, 1980).

RESULTS

The moulded blocks dried within 3-7 days. For the cassava substituted blocks, moisture losses (P>0.05) were between 2.5 and 11.7% of initial weight (Table 3) while for the browse leaves-substituted blocks 2.5 to 10% moisture was lost (Table 4). The DM contents were high. Data on Table 5 show that the Crude Protein (CP) levels in the cassava-substituted blocks ranged from 25.7 to 26.4%. The CP levels in the leaves-bound blocks were between 25.0 - 28% ((Table 6). The strength was however improved when all the leaves were combined with cement at 3% level. With leaves substitution, production cost of the blocks came down by 16-20% relative to the control.

The blocks varied in colour from all brown in the Molasses/Leaves blocks to dirty white in the Cassava starch substituted blocks. The blocks stored properly up to nine months. Wrapping the mixture with cellophane paper during moulding assisted storability up to the ninth month without moulding. This also eased removal of the blocks from the moulds.

TABLE 3: WEIGHTS OF THE CASSAVA SUBSTITUTED UREA-MOLASSES BLOCKS DURING DRYING (g)

	TREATMENTS					
Time in Days	A	B	C	D	E	F
1	1000	1000	1000	1000	1000	1000
2	990.5	993.8	987.5	987.5	975.0	975.0
3	988.5	987.5	962.5	975.0	945.0	950.0
4	980.0	975.0	945.0	925.0	937.0	937.5
5	978.0	962.5	937.5	918.7	900.0	900.0
6	976.0	950.0	925.0	900.0	900.0	883.3
7	975.0	950.0	925.0	900.0	900.0	883.3
% Weight after 7 days of drying	97.5%	95.0%	92.5%	90.0%	90.0%	88.3%

TABLE 4: PROGRESSIVE WEIGHT CHANGES IN THE MOULDED UREA-MOLASSES BLOCKS WITH LEAVES AS BINDERS DURING DRYING (g)

	TREATMENTS				
Time (Days)	1	2	3	4	5
1	1000	1000	1000	1000	1000
2	996.9	987.5	968.7	975.0	987.5
3	987.5	975.0	950.0	943.8	956.3
4	978.1	956.3	918.8	918.8	943.8
5	976.0	940.7	918.8	900.0	925.0
6	975.0	925.0	900.0	900.0	925.0
7	975.0	910.0	900.0	900.0	925.0
% Wt. after drying	a 97.5	b 91.0	b 90.0	b 90.0	b 92.5

TABLE 5: PROXIMATE COMPOSITION AND STRENGTH OF THE CASSAVA SUBSTITUTED MOLASSES-UREA BLOCKS (g/100g DM)

	TREATMENTS					
Parameter	A	B	C	D	E	F
Dry matter	78.0±0.8	78.0±0.8	80.0±1.0	80.4±0.8	83.0±0.4	85.0±1.0
Crude Protein	28.0±0.0	28.0±1.0	28.7±0.4	28.0±0.8	28.3±1.2	28.4±1.8
Ether Extract	1.2±0.1	1.2±0.2	1.1±0.1	1.1±0.2	1.2±0.2	1.1±0.1
Crude Fibre	12.0±1.8	12.0±0.1	12.0±0.5	13.0±0.5	13.0±0.5	13.0±0.1
Ash	28.0±1.0	28.6±1.0	28.6±0.8	28.0±0.4	28.0±0.4	28.6±0.8
Nitrogen free Extractives	32.2±1.8	32.2±3.2	32.6±1.8	31.3±1.9	30.9±2.8	30.9±4.1
Stability in water (days)	5	5	5	5	5	5
Relative change in production cost (%)	0.00	21.77	43.56	65..32	87.09	108.86

TABLE 6: CHEMICAL COMPOSITION AND STABILITY OF THE MOLASSES-UREA BLOCKS PREPARED WITH LEAVES AS BINDER (g / 100 DM)

	TREATMENTS				
Parameters	1	2	3	4	5
Dry matter	70.0±1.0	73.0±0.8	72.0±0.4	71.8±0.8	72.0±0.4
Crude protein	25.0±0.8	28.0±1.2	27.8±0.8	25.0±0.9	24.9±0.8
Ether Extract	1.0±0.2	1.5±0.1	1.3±0.1	1.4±0.1	1.3±0.2
Crude Fibre	10.0±0.1	15.0±0.5	16.0±0.5	15.0±0.5	13.0±1.0
Ash	35.0±0.1	14.3±1.7	14.3±1.2	14.3±0.8	21.4±1.0
Nitrogen free Extractives	28.0±3.0	41.2±3.5	40.6±3.6	43.3±2.3	37.4±3.4
Block strength	Strongest	Strong	Strong	Strong	Stronger
Stability in water (days)	5	3	3	3	4
Relative change in production cost (%)	0.00	-18.01	-18.01	-18.01	-15.00

DISCUSSION

Although the blocks were dried by the 7th day and lost 2-12% of their initial weights, the data show that by the 4th day of drying, they had hardened and lost 2-8% of their moisture. In effect, drying was already achieved by the 4th day. Drying could be faster if prepared during the harmattan period (Onwuka, 1995). Water retention, however, decreased with cassava starch substitution. As feed supplements, the blocks had very high nutrient contents. A preliminary palatability test with goats showed that all the block types were acceptable to the goats and only a little at a time was consumed. The CP levels were high but urea, a non-protein nitrogen substance, supplied more than 95% of the nitrogen. Ruminant animals are, however, equipped to cope with NPN like urea up to 10% level (Preston and Leng, 1987).

With the dwindling supplies of Molasses in Nigeria, coupled with the need to source most Livestock feed ingredients locally, cassava starch should be able to come in as a suitable alternative to sugar molasses since the end product of its metabolism is also glucose units which eventually produce volatile fatty acids and energy. Production cost could increase slightly, but the issue at stake is that of molasses availability and the need to make portable feed supplements as blocks especially for dry season feeding of ruminants' (Sansoucy, 1986). The use of browse leaves could also be described as innovative since they serve the dual purpose of nutrient supply and block binding as indicated by Hassoun (1990) and Preston (1990). The suitability of Gliricidia leaves in block binding has been attested to by Preston (1990). Molasses- urea blocks are known to support animal production to varying degrees (Sansoucy et al, 1988) and for different productive purposes (Combellas, 1991). Undoubtedly, the ease and possibility of preparing small-sized blocks, availability of the ingredients locally and cheaply would make this block making technology fit into the small holder ruminant livestock production systems (Preston and Leng, 1987) in Nigeria, just like elsewhere.

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