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Effects of multinutrient blocks supplementation on the performance of Yankasa sheep fed with basal diet of rice straw in the dry season of Guinea Savanna Region of Nigeria

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ABSTRACT

A research was conducted to determine the effects of two types of multinutrient block with or without molasses and a basal diet of rice straw on the performance of sheep. Fifteen (15) male Yankasa rams aged between 16 and 18 months and having average live weight of 42 ± 1.0 kg were used for the study The sheep were randomly allocated to three treatments group with five sheep per treatment each in experiment the treatments were MNBM with basal diet, MNBW with basal diet and the Control. There was significant ($P<0.01$) difference between the supplemented and the control group. The corresponding values for live weight gain were 0.02g/day, 0.13g/day and 0.15g/day for the control, MNBW and MNBW respectively. A metabolism trial was conducted to assess nitrogen balance in sheep fed a basal diet of rice straw and supplemented with MNBM and MNBW. Three Sheep were used for the trial, representing each treatment group. There was no significant ($P>0.01$) difference in the nitrogen retained between the supplemented group but differs ($P<0.01$) significantly with the control. The nitrogen retained were 5.78g/day, 24.96g/day and 25.87g/day for the control, MNBW and MNBM.

Key Words: Multinutrients block, Rice straw, Yankasa Sheep, Dry season

INTRODUCTION

When energy and protein needs for maintenance of the ruminants falls in the dry season multinutrient blocks upgrade the energy and ammonia levels in the rumen (Mancini *et al.*, 1997). They also offer an attractive possibility because they are cheap and particularly convenient; they are easy to transport and the blocks readily release their nutrients to the animal. Making these nutrients in the form of blocks with cement and molasses as binders also ensures slow release of the nutrients (Steven, 1981).

The use of the blocks as feed supplement in the rural areas will ensure that the animals are not just being maintained but can be sustained for productive performance. The ease of preparation and maintenance make the blocks technology practicable for adoption by small-scale farmers (Ramchurn *et al.*, 2000).

This work gives a brief introductory description of the ingredients used for multinutrient blocks production and summarizes the research undertaken at Mubi for standardizing the formulation of multinutrient blocks and developing a feeding system involving their use as supplements to sheep and cattle.

1.1 Objectives of the study
The main objective of this study is to

i) determine the effects of multinutrient blocks supplementation on the performance of Yankasa sheep fed with basal diet of rice straw in the dry season;
ii) evaluate the cost analysis of multinutrient blocks as feed supplement to ruminants.

MATERIALS AND METHODS

Study Area
The experiment was conducted at the Livestock Teaching and Research Farm of Adamawa State University, Mubi, Nigeria. Mubi is situated in the Northern Guinea Savanna zone of Nigeria at latitude $11^{0\ E}$ and longitude 13^{0} N, and 969m above the sea level (Andrawus and Yusuf, 2001).

The location of Mubi is generally higher compared with other parts of Adamawa State. The elevation ranged from 400-1500 m. The high land mountain ranges from 1200-1500 m; the high plains elevation ranges between 400-800 m and occupy about 40% of the area (Tukur, 1999). The temperature is slightly cool between November and February, and there is a gradual increase in the temperature from January. Monthly mean temperatures range from 16 to 27^{0} C (Andrawus and Yusuf, 2001). The seasonal pattern of relative humidity is low between January to March. It rises in April and reaches a maximum in August (55-80%). The relative humidity decreases as from October following cessation of rainfall (Adebayo, 2004). Monthly rainfall increases from May to August, while it decreases from September to October, the annual rainfall ranged from 1000 to 1050mm (Andrawus and Yusuf, 2001)

Livestock production is a business activity to the people of this region, except for the few nomadic cattle rearers that move their herds in and out of the area depending on the season. Large varieties of animals are kept; the major ones are cattle, sheep, goats, and poultry (Gadiga, 2004).

Experimental Animals
Fifteen (15) male Yankasa rams aged between 16 and 18 months and having average live weight of 42 $\pm$ 1.0 kg were used for the study. The animals were raised at the Adamawa State University Livestock Teaching and Research Farm, Mubi.

Treatments and experimental design
Three treatments were compared in a completely randomized block design. The experimental animals were allotted to three treatment groups with five animals per treatment. The treatments were:

Ts_1 = Multinutrient blocks with molasses + Rice straw
Ts_2 = Multinutrient blocks without molasses + Rice straw
Ts_3 = Rice straw only – control

Housing and management
The sheep were housed in pens made of concrete floor and wall and roofed with corrugated sheets. Clean drinking water was offered *ad libitum*. The sheep were given prophylactic treatments, consisting of intra-muscular injection of Oxytetracycline (LA: 1ml/10kg body weight). They were routinely dewormed with Banminth F^R dewormer (12.5g/kg body weight) and bathed with $Asuntol^R$ powder solution (3g/ litre of water) to eliminate ectoparasites and confined to their pens throughout the experimental period of 16 weeks
The pens were swept daily to remove urine, faeces and the left over feeds. The animals were allowed 10 days adaptation to the diets before measurements were taken.

Data collection
i. Feed intake
Intake of the basal diet and the supplementary blocks were recorded. The rejected feeds was collected and weighed daily before the next morning,s feeding to determine the amount consumed The animals were fed twice daily at 8:00am and 3:00pm.
ii. Live weight change
Weights of the experimental animals were taken at the beginning of the experiment and subsequently at weekly intervals throughout the trial period. The experiment lasted for 16 weeks.

iii. Digestibility trial
Metal metabolism cages were used to determine the intake and digestibility of nutrients. The cages had facilities for collecting urine and faeces separately. The metabolism cages were constructed as described by Oyenuga (1961). Metal was used to cover the top of the cages. Wire mesh (1.91 x 1.91 cm) served as the floor upon which the animals could stay comfortably while allowing for easy passage of urine and faeces.
Removable fine wire mesh on the floor trapped all faeces and allowed passage of urine, which drained into a funnel placed at the mouth of a bottle below the cage in which the urine, was collected. The bottle contained 10 mls of concentrated sulphuric acid to prevent decomposition of nitrogenous compounds in the urine by microorganisms. Feeding and drinking troughs were fixed to the sides of the cages.
One ram at a time from each treatment was randomly selected for the trial for 10 days. The animals were weighed individually at the beginning and at the end of the experimental period.
The basal diet (rice straw) was provided twice daily, at 8.00am and 3.00pm. The multinutrient block supplement was provided at 8.00am daily. The daily feed intake was recorded and samples were taken for chemical analyses.
The urine volume and faecal output were measured daily. Samples of the urine (20 mls) and 10 g of the faecal samples from each animal were collected daily and stored in a deep freezer for further chemical analyses. The adaptation period for this experiment was 7 days and this was followed by 10 days data collection period.
iv. Statistical analysis
The analysis of variance for completely randomized block design was carried out on all data collected using SAS (2001). Significant differences among treatment means were determined using the Least Significant Difference (LSD) method.
v. Cost analysis of feed intake
The costs of basal and multinutrient blocks intake were calculated.

RESULTS AND DISCUSSION

Feed intake and digestibility
The results of feed intake and digestibility of Yankasa sheep supplemented with multinutrient blocks in the dry season are presented in Table I. The dry matter intake of the basal diet was 0.90, 1.03 and 1.23 kg/day for the control, MNBW and MNBM respectively. There was a significant difference (P<0.01) between the supplemented groups and the control. The daily block intake was 0.50 and 0.53 kg/day for MNBW and MNBM and the total daily feed intake was 0.90, 1.53 and 1.76 kg/day for control, MNBW and MNBM respectively.

TABLE I: Effects of multinutrient blocks supplementation on the performance of Yankasa sheep fed with basal diet of rice straw in the dry season

Performance	Diet formulations				
Indices	MNBM	MNBW	CNTL	SED	Sig.Level
Daily mean basal intake (kg)	1.23^a	1.03^b	0.90^c	0.02	**
Daily mean block intake(kg)	0.53^a	0.50^b	0.00	0.07	**
Total mean daily Feed Intake (kg)	1.76^a	1.53^b	0.90^c	0.05	**
Dry matter digestibility (%)	50.04^a	48.72^b	30.11^c	0.09	**
Daily Faecal Output(kg)	0.55^c	0.59^a	0.56^b	0.02	**
Daily Urine Output (litre)	0.53^a	0.51^b	0.58^c	0.02	**
Nitrogen intake (g)	42.94^a	41.82^b	12.40^c	1.60	**
Nitrogen in faeces (g)	9.22^b	9.47^a	2.70^c	0.10	**
Nitrogen in Urine (g)	7.85^a	7.39^b	3.92^c	0.19	**
Nitrogen Retained (g)	25.87^a	24.96^a	5.78^b	1.61	**
Initial mean Live weight (kg)	42.40	42.40	42.40	-	ns
Final Mean Live weight (kg)	59.48^a	57.06^a	44.11^c	0.97	**
Daily mean Live weight Gain (kg)	0.15^a	0.13^b	0.02^c	0.01	**

SED = Standard error of difference between two means; abc = ^{abc} Means within same row having different superscripts differ significantly
** = (P<0.05); * * = (P<0.01); ns = non Significant; MNBM = Multinutrient Blocks with Molasses; MNBW = Multinutrient Blocks without Molasses; CNTL = Control (Rice straw only).*

Supplementation with multinutrient blocks significantly (P<0.01) increased the intake of the basal diet. It provides a high potential for improving the utilization efficiency

The block provides an almost continuous supply of nutrients which is usually deficient in straws that limits fibre digestion in the rumen.

Improvement in the basal diet intake due to multinutrient blocks supplementation has been reported by some workers (Leng *et al*., 1991; Bheekhe *et al.,* 2002; Singh and Singh, 2003).

The response to supplementation appears to have been entirely associated with stimulation of rumen microbial activity and for stimulation to occur the blocks must have provided nutrients that were limiting microbial growth. Multinutrient blocks can be a source of rumen protein, macro and micro minerals, vitamins, pharmaceuticals and additives to manipulate rumen fermentation (Hadjipanayioutou *et al,* 1993a).

The results in this study are similar to the findings of Bistanji *et al*. (2000) who studied two formulated blocks with a variety of products with or without molasses and recorded dry matter intake of 1.0–1.5 kg/day in cereal straw supplemented with blocks, and block intakes of 0.50 – 0.60 kg/day. Mata and Combellas (1992) observed an intake of 1.03 kg/day when poor quality straws were supplemented with multinutrient blocks. Salman (2007) reported a similar intake (1.23 kg/day) in Awassi sheep fed untreated cereal straw supplemented with multinutrient blocks. Other workers who reported similar finding include Kusmartono (2002, 2007); Hendratno (1997) and Hadjipanayiotou *et al.* (1993b).

The mean daily block intake in this study was slightly higher than the 400 g recommended by Food and Fertilizer Technology Centre, FFTC (2006) and Samad and Siddiki (2004). Other lower values than what was obtained in this study were reported by Menge and Xiong (1993) and Salman (2007).

Sansoucy *et al*. (1988) reported that intake of blocks varied with the type of animal (lambs 400 g, Awassi sheep 300 g and 293 g). He further stated that the intake of multinutrient blocks is related to their hardness and palatability; the harder the block, the lower the intake and *vice versa*.

The dry matter digestibility ranged from 30.11% for the control to 50.04% for supplemented groups fed on multinutrient blocks (Table I). There was a significant (P<0.01) difference in the dry matter digestibility between the control and the supplemented groups. Multinutrient blocks are known to create an efficient rumen ecosystem favourable for fibre digestion (Leng *et al.,* 1991). Ojo *et al.* (2001) and Habib *et al.* (1994) reported similar dry matter digestibility values when sheep were supplemented with multinutrient blocks.

The nitrogen intakes were 12.40, 41.82 and 42.94 g/day for the control, MNBW and MNBM respectively. The nitrogen intake of the supplemented groups were significantly (P<0.01) higher than the control. The nitrogen intake of the supplemented groups is slightly higher than the 35.6 and 34.3 g/day reported by Moujahed *et al.* (2000) and Sundstol *et al.* (1978) for sheep.

The faecal nitrogen output was 2.70, 9.22 and 9.47g in control, MNBM and MNBW treatment groups respectively (Table I). There was a significant (P<0.01) difference among the groups. The groups on multinutrient blocks performed better than the control. The faecal nitrogen obtained in this trial was much higher than the 3.39 ±0.22, and 3.25 ±0.20g in sheep offered multinutrient blocks with or without molasses reported by Samanta *et al*. (2003). The decrease in faecal nitrogen in the supplemented groups may be as a result of better nitrogen utilization (Barry *et al.,* 1986).

The urinary nitrogen was 3.92, 7.39 and 7.85 g/day for control, MNBW and MNBM respectively. The urinary excretion was higher in the supplementary group and lowest in the control and may be due to low nitrogen in the diet of the control.

The nitrogen retained was 5.78, 24.96 and 25.87 g/day for control, MNBW and MNBM. Nitrogen retention increased (P<0.01) significantly in MNBM and MNBW respectively. This implies that the blocks had higher potentials in contributing nitrogen to the animals in the supplemented than the control group. Other workers

(Sundstol *et al.,* 1999 and Ibrahim *et al.,* 1983) reported that higher nitrogen retention may be achieved when low quality straws are supplemented with multinutrient blocks.

Live weight changes

The result of daily live weight changes inYankasa sheep is presented in Table I. The mean live weight changes were 0.02 kg for control, to 0.13 kg for MNBW and 0.15 kg for MNBM. There was a significant ($P<0.01$) difference between the supplemented and the control group. The higher live weight gain in the supplemented groups may be due to higher nitrogen, minerals and vitamins in the blocks which in turn enhanced growth and the supply of rumen degradable nitrogen and by - pass protein. The animals offered blocks had a better body condition and looked healthier than the animals on the control diet.

This result is consistent with the findings of Salman (2007) who reported a live weight gain of 100 – 150 g/day in sheep supplemented with multinutrient blocks to a basal diet of rice straw in Iraq. Samanta *et al.* (2003) also reported live weight gains of 110 – 150 g/day when they evaluated complete feed block on nutrient utilization and rumen fermentation in Baribari goats fed a basal diet of rice straw.

Lower values of growth rates have been reported in sheep fed untreated rice straw plus different levels of supplemented multinutrient blocks (Jian-Xin liu *et al*., 1995 and Ma *et al.*, 1995) and other workers (Leng *et al.*, 1983; Ibrahim and Schiere, 1985; Rica and Combella, 1993; Wanapat, 1995, 1999). The difference in live weight gain between the supplemented groups and the control group could be explained by the fact that multinutrient blocks provided microbial growth factors such as sulphur and the trace elements which stimulate higher dry matter intake. The positive effect of multinutrient blocks on overall performance of an animal will be more pronounced on a low plane of nutrition, that is, a crop residue or straw-based diet given in large quantities.

In an experiment with sheep and goats, Jian *et al.* (1995) found that multinutrient blocks can be used to improve the productive performance of animals with access to roughages of low nutritive value.

4.8: Cost analysis of feed intake

The cost analysis of feeding sheep with rice straw supplemented with multinutrient blocks is presented in Table 2. The highest feed cost of ₦11.57 per head/day was obtained in the group on blocks with molasses, daily cost of block intake without molasses per animal/day was ₦7.54, while the rice straw (control) intake was ₦9.00 per head/day. The cost per unit (₦) kg gain for MNBM, MNBW and the control was (₦) 157.84 (₦) 136.29 and (N) 589.47 respectively.

TABLE 2: Cost analysis of feed intake of Yankasa sheep fed with basal diet of rice straw in the dry season

	Treatments		
Parameters	**MNBM**	**MNBW**	**CNTL**
Block intake (₦/day/animal)	11.57	7.54	00.0
Basal intake (₦//day/animal)	10.30	8.3	9.00
Total basal and block intake (₦/day/animal)	21.87	15.84	9.00
Total intake per treatment (₦/day)	109.35	79.20	45.00
Total weight gain (kg)	17.08	14.66	10.08
Cost per unit gain (₦)	157.84	136.29	589.47

MNBM = Multinutrient blocks with molasses; MNBW = Multinutrient blocks without molasses; CNTL = Control (Rice straw only)

The least cost per (₦) kg gain was obtained in blocks without molasses as against multinutrient blocks with molasses and may be due to high cost of molasses. The cost of block intake was slightly lower than those reported by Mwenda and Khatsatsilli (2008) Ramchurn and Ruggoo (2000). This may be due to the differences in the cost of the ingredients used in the production of the blocks. The cost of blocks with molasses was higher than those without molasses and may be due to the additional cost incurred in procuring molasses.

CONCLUSION

The experiments with sheep during the dry season have improved available knowledge on the positive effects of using multinutrient blocks as a supplement to animals on poor quality straws and ruminants grazing natural pastures. The encouraging results on feed intake, live weight gain, nutrient digestibility and cost analysis of production and utilization futher justify the need for the use of the multinutrient blocks as supplements for sheep.

Although preparations and handling of blocks may be cumbersome processes multinutrient blocks are economic and acceptable method of feeding urea and molasses provided molasses is available to the farmers at a reasonable price. Multinutrient blocks can be fed throughout the year but are more beneficially utilized during the dry season or when the animals are grazing low quality fodder (Bheekhee *et al*., 2002). Rice is one of the most important staple foods crops grown in northern Guinea Savanna zone and the use of the straws for animal feed has been widely practiced by farmers; its utilization should be maximized by adopting the technology of multinutrient blocks supplementation which are technically easy to be adopted by farmers and economically feasible.

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