

Effect of Molasses urea blocks (MUB) as strategic dry season supplement to yearling heifers raised on low quality roughages

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SUMMARY

Three experiments were conducted to evaluate the effect of molasses urea block (MUB) supplementation on the utilization of poor quality roughages by yearling dairy heifers during the dry season. In

experiment 1, twenty crossbred heifers (11-12 months old) were divided into two treatments (T1 and T2) of 10 animals each. Animals on treatment 1 (T1) were grazed on natural pastures hay only whereas those on treatment 2 (T2) received MUB upon return from grazing. Data on growth rate were recorded over 90 days, weighing being taken once every fortnight. In Experiment 2, ten (11-14 months old) crossbred heifers were used to assess voluntary intake of heifers. The animals were divided into two groups of five each (T1 and T2) and stall fed two dietary treatments in a change over design. Total feed intake, MUB intake and hay intake were recorded daily. Initial and final body weights of the animals were also recorded. In Experiment 3. the degradability characteristics of hay, rumen ammonia nitrogen and

pH were measured using 3 fistulated steers fed the two dietary treatments used in Experiment 1.

Supplementation with MUB significantly ($P<0.001$) reduced intake of hay but increased total dry matter intake (DMI) significantly ($P<0.001$). The daily intake of both nitrogen and energy were higher in supplemented than the un-supplemented group. Average daily gain (ADG) and feed conversion efficiency were significantly ($P<0.001$) higher for the MUB supplemented group than the un-supplemented group. Degradability of hay incubated in the rumen supplemented animals were higher than for the un-supplemented. The mean rumen ammonia concentration was significantly ($P<0.001$) higher in supplemented than un-supplemented (224.6 vs 53.72 mg N/l respectively). There was no significant difference ($P>0.05$) in pH levels between the two groups.

It was concluded that MUR supplementation is a simple way of improving performance of ruminants fed on poor quality roughage during the dry season.

INTRODUCTION

In dry season under nutrition is one of the major causes for the low performance of ruminants in East Africa. Over the six to seven months of dry season, most livestock keepers in Tanzania rely on the use of fibrous crop residues and poor quality natural pastures both of which are low in nitrogen and energy. Consequently animals raised on these feeds exhibit slow growth, delayed age at breeding, poor lifetime reproductive performance, low mature weights and low milk yields (Mujuni *et al.* 1990; Kifaro and Temba, 1990).

In recent years a number of reports have been published on the use of fertilizer grade urea in combination with sugar cane molasses in ruminant feeding (Sansoucy 1986). The two ingredients when used in combination provide two major dietary components i.e. energy and nitrogen needed by the growing heifer (Tiwari *et al* 1990). The nitrogen so provided also help in improving the intake and digestibility of the low quality fibrous residues (Leng 1984) whereas the rapidly digestible energy from molasses provides the necessary substrate for proper rumen microbial activities (Prasad and Sampath 1988). The present study attempts to evaluate the use of Molasses-Urea combination in dried blocks (MUB). It is expected that MUB should prove to be nutritionally adequate for growing heifers and convenient to use by the smallholder. The techniques involved in its production are simple and can easily be adopted by local artisans.

MATERIALS AND METHODS

Three experiments were conducted (two at Kibaha Livestock Multiplication. Unit and one at SUA) to assess the feeding value of molasses-urea blocks as a supplement to growing heifers. In Experiment 1 twenty 11-14 month old crossbred heifers were divided into two groups of 10 animals each and were randomly allocated to two treatments (T1 and T2). The T1 animals were grazed for 8 hours without supplementation whereas the T2 animals received the MUB supplement upon return from 8 hours grazing. Both groups were grazed on the same pastures. Data on weight changes was collected for 90 days after a preliminary period of 14 days. Animals were weighed

once every fortnight, on each occasion the weighing being done in the morning before the animals were allowed to graze.

For Experiment 2 ten crossbred heifers (12-14 month; 95-120 kg) were randomly allocated to two treatments of 5 animals each in a change over design. Group 1 animals (T1) received hay without supplement whereas group 2 animals (T2) were offered MUB in addition to hay. Feeding was done twice daily in individual pens. Data on voluntary intake were taken for 14 days after a preliminary period of 7 days. A change over to either T1 or T2 was done at the end of each 14 day period and 7 days were allowed for adaptation to the new treatment. This arrangement improved the number of replications per treatment. The MUB used for this experiment weighed 4.5kg. It was left to hang in the pen at a height that allowed the heifer to lick but not to chew.

Experiment 3 was done at SUA. Three fistulated Boran steers were used for the determination of degradability characteristics of the hay used in Experiment 2 and the parameters of rumen

environment for steers given the MUB supplement. Adaptation period of 14 days was allowed before incubation of nylon bags in the rumen. A change over arrangement was adopted. Each period lasted for 14 days during which two steers received MUB in addition to the basal diet of poor quality hay while the third steer was given hay only. Rumen liquor was collected at the end of the period, collection being done at 2 hours intervals for 24 hours.

Sampling of Experimental diets:

Random samples of forages were taken from the grazing area during grazing time (Exp. 1) on different days to monitor the changes

in quality. For (Exp. 2) the sampling was done on the hay offered and the components that were refused. Sampling was done everyday for each individual heifer and bulked over the whole experimental period. Subsamples were then taken at the end of the period for chemical analysis. Similar approach was taken for the sampling of the MUB. ***Chemical analysis:***

The standard AOAC (1990) procedures were adopted for the analysis of chemical components of the feeds.

For Dry matter (DM) and organic matter (OM) degradability the nylon bag technique described by Orskov *et al* (1980) was adopted.

Rumen pH and Rumen NH₃-N were determined using respectively the portable pH meter and the kjeldahl (AOAC, 1990) procedures were used.

Statistical Analysis:

The SAS GLM procedure for analysis of variance was adopted using, appropriate models for each experiment. For Experiment 1 the model included a covariate for the correction of variation in the initial body weight. In Experiment 2 the effect of the period was included.

In Experiment 3 the DM and OM degradabilities were defined and assessed using the NAWAY computer programme as outlined by Orskov and McDonald (1979).

RESULTS

Experiment 1 : 'Growth study:-

Table 1 gives a summary of the chemical composition of the feeds used in all the three experiments. In addition to information on hay, chemical composition of the natural shrubs in areas where the animals

were grazed is also shown. The CP content of shrubs was about three times higher than that of hay and so were the Ca and P contents. The Ca content in the MUB satisfied the levels intended for the experiments whereas the Ca : P ratio seemed to be exceedingly skewed in favour of Ca.

Table 2 shows the least square means (LSM) of the growth performance of heifers under the two feeding regime. Animals in T2 consistently showed a higher rate of weight gain than those in Ti. Except during the 6th week, heifers in T2 gained at a rate about 3 to 4 times higher than those in Ti.

Experiment 2 : Intake study:-

The feed DM, CP and ME intakes for the two treatments are shown in Table 3. Heifers receiving the MUB supplement (T2) consumed significantly higher ($P<0.001$) total DM, ME and CP than those not receiving the supplement. This was shown despite the lower intake of hay among the T2 heifers. The MUB supplement seems to have caused a comparatively lower intake of hay for the T2 heifers. However, the T2 heifers still sustained an overall DM intake froth hay within 37% of the metabolic weight. Total ME intake by T2 heifers was significantly higher ($P<0.001$) than that of T1 heifers. Similarly, the CP intake was nearly four times higher among the T2 heifers than for the Ti.

Experiment 3 : Dill and OM degradability :-

As for the the pattern and extent of DM and OM degradabilities of low quality hay in supplemented and unsupplemented (control) steers it can be noted that although the pattern was similar for the two groups, the rate and extent were found different. Degradability of hay in supplemented steers was significantly faster and higher than in the

control group. By the 72nd hour of incubation the DM degradability seemed to have reached a plateau for the unsupplemented ones.

Table 4 shows the mean values for rumen pH and $\text{NH}_3\text{-N}$ in the Ti and T2 steers at various pre and post-feeding intervals (hrs). It can be observed that there was no significant difference ($P>0.05$) in pH levels between the two treatments.

However, for both T I and T2 steers there was a general fall in pH within 4-6 hours after second feeding. This fall was very slight, and shortly afterwards the levels recorded at feeding time were restored.

A highly significant difference ($P<0.001$) between treatments was observed in the rumen levels of ammonia nitrogen. Animals receiving the MUB supplement had about 4 to 5 times higher amounts than those not receiving the supplement, The differences were especially remarkable shortly after feeding.

DISCUSSION

After a series of trials an appropriate formula of MUB was achieved. This formula contained CP and ME levels as intended for the experiments (Table 1). The low levels of CP and the high levels of NDF and ADF for the hay used were expected and provided a good opportunity to demonstrate the actual effect of supplementation.

The CP value for the MUB used in these experiments was similar to that reported by Tiwari *et al* (1990) but lower than the values given by Prasad and Sampath (1988), Garg and Gupta (1991) and Elongavan *et al* (1991). The differences noted could have been due to the different levels of the nitrogen sources used in compounding the blocks. Fertilizer grade urea used in the present studies contained

about 46% N and was included at 10% level in the block. This was expected to supply about 46g of N per kg of the block. In addition the rice bran with 2.04% N was included at 32% level in the block. The two components together should have provided 52.5g N/kg block. The analysis (Table 1) shows that this was very closely achieved and that the N content in the block was fairly stable over the entire

experimental period.

The total ash content of 231 g/kg block obtained in this study was similar to the ranges reported by El-Khidir (1988) and Tiwari *et al* (1990). However, the mineral distribution of Ca and P was not in the recommended ratio of 2:1 in favour of Ca. Indeed the level of P was much lower than the values reported by Tiwari *et al* (1990) and Prasad and Sampath (1988). The principal mineral sources (i.e. limestone, cement and common salt) were added in the block at about 20%. The analysis (Table 1) suggests that the mixing was sufficiently thorough and that molasses used was a good carrier of the minerals. It would have been proper though, if blood parameters were also taken to verify mineral uptake by the heifers. At the intake rate of 1kg block/day (Table 3) the Ca intake was expected to be more than twice the recommended daily allowance of 20g/day for a 200kg heifer, while that of P was inadequate to meet the requirement of 10g/day (ARC, 1980). It was hypothesised that supplementation with MUB would improve the voluntary intake of the basal ration thereby improving the growth performance as well. Table 3 shows that MUB

supplementation actually reduced (by about 32%) the intake of hay. This observation is at variance with several other workers (Leng, 1984; Kunju, 1986; Mlay, 1994) and suggests that MUB supplementation had a substitution effect on intake of hay.

Substitution effects of supplements are known to occur wherever their

level of intake are in excess of 25% of the total intake (Beever, 1993; Church and Santos 1981; Dixon 1984). Beever (1993) contends that when excessive amounts of supplements are consumed by the animal the stimulatory effect on the rumen which accounts for increased intake and digestibility of poor quality roughages is impaired leading to reduction in both intake and digestibility. In the present study the heifers consumed nearly 40% of the total DM from the supplement. It can be argued that a slight restriction to limit the MUB intake to about 20% of the total DM intake could have reduced the fall in hay intake and consequently make the use of MUB as supplement more cost effective. Despite the reduction in hay intake the overall DM consumption was significantly higher for the supplemented group. The total intake of energy (ME) was improved nearly threefold and that nitrogen increased by over 400%. This explains the significantly higher growth rate noted among the supplemented group (Experiment 1) and suggests that the positive results may have been partly due to the improvement of the total intakes of DM, CP, ME and OM.

The high rumen NH₃-N levels (Table 4) for the supplemented group may be interpreted as an improvement in rumen nitrogen status. This should be expected to also lead to a better rumen capacity for degradation of low quality hay and consequently an improvement in total intakes of digestible DM and OM and in growth performance. 130th aspects were achieved as evidenced by the high ME intake and the comparatively faster and higher rate of DM and OM

degradabilities shown by, respectively, heifers and steers receiving MUB supplement (Table 3).

The average daily intake of MUB was about 1kg, containing 889 g of DM. This provided about 290 g of CP per day, a level sufficient to meet the daily requirements for a heifer gaining up to 500 g/d

ABOUT AND OTHERS

(McDonald *et al* 1988). Heifers in the present study gained about 200g/d, an amount which could be regarded as lower than theoretical expectations. The less than optimal performance could pose questions on the economic advantages of MUB supplementation. The current market price of the MUB is about Tsh. 2,500/= for a 10kg block. Assuming an intake of 1kg per day the cost of gain would be Tsh. 1,250/= per kg live weight. Where beef finishing is done over a 120 days period, the total MUB cost would be expected to be Tsh. 30,000/= and revenue from gain Tsh. 18,000/= (assuming 50% carcass dressing). At this rate and with considerations on the current price of beef (i.e Tsh. 1,500/= per kg.) it would seem that there is little justification for the MUB supplementation. However, it should be emphasised that the objective of the current study was to formulate a dry season feeding strategy that minimizes growth check of replacement heifers. The positive response recorded was therefore an achievement of value and may have implication beyond the economics as expounded above.

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