Use of Molasses Containing Urea as a Supplement to Pangolagrass Pastures in Northeast Mexico

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Highlight: *Supplements of molasses, molasses + 3% urea, and molasses + 6% urea at a level of approximately 1 kg/head/day on pangolagrass pasture during the winter and spring months resulted in significantly increased weight for ¾ Zebu x ¼ Criollo bulls. Urea was more effective during the winter months when forage availability was at its lowest, than during the spring months. It is suggested that the use of pangolagrass pasture with molasses and urea supplementation when appropriate could significantly increase production from rangeland.*

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Using statistics provided by FAO (1967), it may be calculated that about 6 million metric tons of molasses are produced yearly in the Latin American area. Only a limited quantity of this molasses is used industrially and thus a large amount is available for animal feeding.

Molasses has been used both in the feeding of intensively fed cattle (Preston et al., 1964) and as a supplement to pasture during periods of scarcity of forage during cool or dry conditions (Carrera et al., 1963).

In increasing the production of beef from tropical and subtropical grasslands, both from "tame" pastures and range, it is important to investigate how production per unit of surface area may be

increased by correcting seasonal deficiencies in both quantity and quality of forage. The object of this experiment was to investigate the use of molasses as a supplement of energy, combined with various levels of urea as a supplement of nonprotein nitrogen, on pangolagrass (*Digitaria decumbens* Stent.) pastures during winter and spring when grass growth rate was reduced.

Material and Methods

This experiment was carried out in the district of Aldama in the state of Tamaulipas, N. L., Mexico. Pangolagrass pastures have been established in small areas with favourable precipitation in a zone which can be considered basically range. The climate is generally humid (629 mm annual rainfall), but there is a definite seasonal decline in pasture productivity from November until March. Four pastures each of approximately 8 hectares were used. These were even stands of pangolagrass which had been established for some years. During the previous year, the pasture had been more or less constantly grazed and no fertilization or other conditioning had been practiced.

One group of 12 bulls, approximately 3/4 Zebu x 1/4 Criollos between 12 and 18 months of age and weighing approximately 240 kg, was allocated at random to each of the four pastures. Each bull was identified by both ear tags and hot-iron brands, and each was free from parasites prior to the study by use of a systemic parasiticide.

The research treatments were: grazing with no supplement, grazing plus approximately 1 kg per day of molasses supplement, grazing plus 1 kg per day of molasses containing 3% urea, and grazing plus 1 kg per day of molasses containing 6% urea. Urea was dissolved in the minimum amount of water necessary to guarantee even mixing, and the weight of the molasses fed was adjusted accordingly.

The stocking density was equivalent to approximately 1.5 animals per hectare, a value which reflected common management practice in the area. After a 14-day preliminary period to accustom the animals to the experimental conditions, they were weighed and allocated, again at random, to treatments.

Molasses or molasses with urea was fed in open troughs and put out at 3-day intervals in quantities necessary to proportion approximately 1 kg per head per day. This method insured that all animals had opportunity to eat at the troughs. A mixture of salt and bonemeal in the proportion of 1:1 was available free-choice at all times.

Animals were weighed at 28-day intervals. The experiment lasted a total of 112 days from February through May. At the date of each weighing, groups were changed from one pasture to another in such a way that each group spent one period in each pasture, thus minimizing any possible differences among pastures.

Samples of grass were taken from each pasture during each period for analysis of protein content.

Results

Values for initial and final weights, daily gain during the various periods, and actual molasses consumption are given in Table 1. In view of the disparity of the initial weights, a covariance analysis was used to compare weight gains. Significant differences were demonstrated to exist among treatments. Groups fed molasses alone and molasses + 6% urea gained significantly more weight ($P > 0.05$) than the group without supplementation and that fed molasses + 3% urea; the apparently anomalous situation of the latter group was entirely due to low gains during the third period. When the results for this period were not considered, this treatment was similar to the other supplementary treatments. Gains per head of 578, 765, 785, and 779 g per day for animals on treatments 1, 2, 3, and 4, respectively, was significantly superior to that of unsupplemented animals.

A highly significant difference was found to exist among weight gains attributable to period. Mean weight gains for the four periods were 565, 689, 809, and 924 g/day for the first, second, third, and fourth periods, respectively. No interaction could be demonstrated between effects due to periods and those due to treatments.

The mean protein content of the grass (expressed on a dry matter basis) was 3.6%, 3.8%, 4.5%, and 4.4% for the first, second, third, and fourth period, respectively.

Discussion

In general, the only exception being the treatment involving molasses + 3% urea during the third period, gains were better for the supplemented groups than for the unsupplemented group. This difference amounted to an average value of 197 g per head per day. The exception previously mentioned may be explained by the fact that heavy rains occurred during this period and the pasture in which the animals fed molasses + 3% urea were grazing was slightly flooded, reducing forage availability and thus intake.

Results are in agreement with those of Carrera et al. (1963), who showed that supplementation with molasses was effective during periods of shortage of forage but not when abundant forage was available. Similar results were obtained by Chapman et al. (1965) using beef cows in Florida and by Chapman et al. (1961) working with steers.

During the first period there was a marked indication that growth rates were greater with increasing levels of urea supplementation; however, this tendency reached statistical significance only at the 10% level when the results for this period were analyzed alone. The mean value for protein content of grass sampled during this first period was lower than the mean literature values of 5.6% for pangolagrass subjected to constant grazing (Butterworth, 1968). Using the equation developed for digestibility of the protein of pangolagrass (Butterworth and Diaz, 1970), it may be calculated that the apparent digestibility of this fraction was clearly insufficient to maintain optimum growth rate. Some effect of supplementary nonprotein nitrogen was therefore to be expected during this period, although the actual protein ingested by the animals was probably higher than that indicated by the analysis because of selective grazing. Weight gain during subsequent periods was apparently limited by energy rather than protein provision.

Increased weight gains as the experi-

Table 1. Starting and final weights, daily weight gains, and supplement consumption of bulls grazing pangolagrass supplemented with molasses, molasses + 3% urea and molasses + 6% urea during four periods of 28 days each.

Treatment	Control	Molasses	Molasses + 3% urea	Molasses + 6% urea
Starting weight (kg)	245.4	235.4	238.9	242.3
Final weight (kg)	315.0	325.3	321.5	334.9
Daily gain (gm)				
1st. period	388	528	603	740
2nd. period	564	691	864	639
3rd. period	751	925	592	968
4th. period	781	1066	888	960
Overall*	621 a	802 b	736 a	826 b
Consumption of supplement (gm)		889	901	799

*Values bearing the same letter are not significantly different from each other.

ment progressed were presumably attributable to augmented availability of forage. In order to investigate factors influencing growth of forage, mean weight gains for each period were correlated with the corresponding mean ambiental temperatures (15.7°C, 20.1°C, 24.1°C, and 27.5°C for the first, second, third, and fourth periods, respectively). The correlation coefficient obtained was 0.998 ($P<0.01$) with a value for the regression coefficient (b) of 30.3 g. This indicated that gain in weight per day increased 30.3 g for every 1°C increase in temperature. No relation was discernible when similar calculations were made with precipitation data. It may therefore be concluded that during the period in which the present study was carried out, the growth rate of the grass was limited by temperature rather than by moisture. This is in agreement with results obtained by McCloud et al. (1957), who showed that the growth of pangolagrass was considerably reduced by a temperature change from 21°C to 10°C.

There was some indication that intake of molasses + 6% urea was somewhat lower than that of molasses + 3% urea, although this tendency was not marked. Similar results have been reported by Beames (1960), who used molasses/urea mixtures as supplements to pasture and by Preston et al. (1967), who used similar mixtures as a supplement to a grain diet.

Although it is often considered that there is little relation between range and "tame" pastures, the authors feel that the latter can be used as valuable adjunct to increase the efficiency of adjoining rangeland. Specific applications could not only include raising calves produced in cow/calf operations after weaning with subsequent grass fattening but could also provide a useful reserve of forage for the reproducing herd during critical periods.

An economic evaluation of the data indicated that supplementation in all cases studied would be expected to be beneficial under general market conditions prevailing in Mexico.

Summary

Forty eight young 3/4 Zebu x 1/4 Criollo bulls were used in an experiment to determine the effect of molasses, molasses + 3% urea, and molasses + 6% urea at a rate of approximately 1 kg per head per day as a supplement to pangolagrass pasture with a stocking density of 1.5 animals per hectare. The study was carried out in northeast Mexico during the months of February through May, a period when pasture growth is reduced. Significant improvement in growth rate was caused by all supplementary treatments (with the exception of molasses + 3% urea during the third month), and it was concluded that such supplementation may be recommended during periods of reduced forage availability. During the first period, when forage availability was at its lowest, there was an indication that animals responded to increased levels of urea, although this tendency did not reach significance. No beneficial effect attributable to urea was noticeable during subsequent periods.

A significant increase in growth rate of the cattle took place as the experiment progressed; the correlation between mean ambiental temperature and weight gain for the corresponding periods was highly significant, the regression of growth rate on temperature increase being 30.3 g per day per degree centigrade increase. It was concluded that during the period of the experiment, temperature was more limiting to grass growth than was precipitation. Findings were discussed with reference to other studies published in this field.

It is suggested that the use of such supplementation of pangola with molasses can provide a useful additional source of forage for surrounding range areas in certain parts of northeast Mexico.

Literature Cited

Beames, R. M. 1960. The supplementation of low quality hay and pastures with molasses and molasses urea mixtures. Proc. Austral. Soc. Anim. Prod. 3, 86p.

Butterworth, M. H. 1968. Una nota sobre el contenido de proteína cruda en pasto pangola bajo diferentes sistemas de manejo. Revista Mexicana de Producción Animal. 1: 29-31.

Butterworth, M. H., and J. A. Diaz. 1970 Use of equations to predict the nutritive value of tropical grasses. J. Range Manage. 23:55-58.

Carrera, C., H. Munoz, and L. Solares. 1963. Melaza de caña como suplemento en el engorde de bovinos en zacate guinea. Técnica Pecuaria en México. 1:34-37.

Chapman, H. L., C. E. Haines, and R. W. Kidder. 1961. Feeding value of limited fed mixed feed, citrus pulp, ground snapped corn and blackstrap molasses for fattening steers on pasture. Everglades Station Mimeo. 61-19.

Chapman, H. L., R. W. Kidder, M. Koger, J. R. Crocket, and W. K. McPherson. 1965. Blackstrap molasses for beef cows. Florida Agr. Exp. Sta. Bull. 701. 31 p.

F.A.O. 1967. Production Yearbook 20. Food and Agriculture Organization of the United Nations. Rome, Italy.

McCloud, D. E., O. C. Ruelke, and J. M. Creel. 1957. Pastures: Summer rich and winter poor; research under way seeks forages that are cold hardy. Rep. Fla. Agr. Exp. Sta. 2(1):8.

Preston, T. R., M. B. Willis, and A. Elias. 1967. Intensive beef production from sugar cane 1. Revista Cubana de Ciencia Agricola. 1:33-40.