CONTROLLING INTAKE OF MOLASSES WITH MONENSIN

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SUMMARY

The rumen modifier monensin was tested as a potential regulator of the amount of supplementary molasses eaten by roughage-fed cattle. Forty-eight steers were fed molasses plus either 4% or 8% urea, with from 0 to 120 mg monensin/kg of molasses.

Increasing the concentration of monensin reduced the intake of molasses. The effect was greater when monensin was fed with molasses containing the lower level of urea (up to 45% reduction) compared with the higher level of urea (up to 30% reduction). Monensin was as effective as urea for regulating the intake of supplementary molasses, but also has nutritional and therapeutic advantages.

INTRODUCTION

The feeding of supplements to cattle is most effective when there is control over the amount of supplement eaten. There is then some opportunity to achieve maximum economic return by manipulating the cost/benefit relationship.

However, regulating the intake of supplements by grazing cattle presents many problems. Physical regulation, for example by restricting access to the supplement, is often expensive and impractical. Intermittent feeding is often practised, but can be time-consuming. While weekly *or* twice-weekly feeding generally gives more uniform distribution of the supplement throughout the herd than daily feeding, intermittent feeding has disadvantages if continuous intake is desired.

The use of unpalatable additives can overcome many of these problems, by reducing the rate and extent of consumption of the supplement. Ideally, as well as reducing intake, these additives should have nutritional benefits to help offset their cost. One such additive is urea, which reduces the intake of molasses supplements when included at levels greater than about 2% (Beames 1960; Veitia *et al.* 1972).

Molasses plus 8% urea is now widely used in the northern cattle industry as a supplement for all classes of stock. Approximately 3% urea is required to overcome the nitrogen deficiency of molasses (Preston 1972) and a further 1-2% urea should be sufficient to supplement the poor quality roughage eaten by the animal. This suggests that about one third of the added urea is surplus to the animals' nutritional requirements, and this extra urea increases the cost of the diet by about 10-15%.

The rumen modifier monensin (Rumensin - Elanco Australia) has already been shown to improve the utilization of supplementary molasses '(Lindsay pers. comm.). Bube et *al.* (1984) reported that monensin reduced feed intake by 40% when included at 50 mg/kg of molasses, and in recent lot-feeding experiments monensin reduced the intake of molasses by about 30% when included at the rate of 30- 45 mg monensin/kg molasses (Gulbransen unpubl.).

These results, together with its relatively low cost, suggest that monensin could be a useful regulator of the intake of molasses supplements.

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The following experiment, at Brian Pastures Research Station, in sub-coastal south-east Queensland, demonstrated the effectiveness of a range of concentrations of crystalline and granular monensin for controlling the intake of molasses-based diets.

MATERIALS AND METHODS

After stratification on the basis of fasted live weight (24 h without feed, 12 h without water), forty-eight yearling Brahman cross steers (mean live weight 301 ± s.d. 19.5 kg) were randomly allocated to groups of two steers. Pairs of steers were then assigned to treatments in a 2 x 4 factorial design, with two molasses supplements (4% and 8% urea) and four concentrations of monensin in the molasses (0, 40, 80 and 120 mg/kg), replicated three times.

The steers were held in concreted yards each 20 m^2 in area, and on alternate days also had access *to* gravelled exercise yards each 30 m^2 in area. Each day they were fed 2.5 kg/hd of chopped, poor-quality speargrass hay (crude protein 4.2%), and had *ad libitum* access to the appropriate supplements. The molasses/urea supplements (4% or 8% urea) also contained 1% mono-ammonium phosphate (MAP) and 1% salt, plus the appropriate concentration of monensin added as Rumensin Homemix (2% monensin). The molasses/urea/MAP/salt mixture was prepared in an 1800 1 commercial paddle mixer, but the monensin was added to individual feed troughs and stirred in with a hand-held mixer. Molasses for the base mix was measured volumetrically, and the mixture was sampled and analysed so that actual concentrations of urea could be calculated,

The crystalline form of monensin was used for the first six weeks. The experimental groups were then re-allocated to treatments and, following an adaptation period of one week, granular monensin was used for a further six weeks. Throughout the experiment the steers *were* weighed fortnightly and intakes of the molasses mixes were measured fortnightly. Mean intakes of the molasses mixes and changes in live weight *were* compared by analysis of variance using the pen as the experimental unit.

RESULTS

When crystalline monensin was being tested the actual concentrations of urea in the molasses mixtures were 3.3% and 6.6%, rather than the intended 4% and 8%. The concentrations were 3.9% and 7.7% respectively when granular monensin was being tested. The intake of molasses mixes containing the higher level of urea was significantly ($P<0.01$) less than that of mixes containing the lower level of urea (Table 1). This was particularly marked during the period when granular monensin was fed. Increasing the concentration of monensin in the molasses mixes significantly reduced intakes of the mixes ($P<0.01$), whether using crystalline or granular monensin (Table 1).

At any given concentration of urea, increasing the concentration of monensin generally reduced the amount of molasses eaten, and at any given concentration of monensin, increasing the concentration of urea always reduced the amount of molasses eaten. However, the monensin had a greater effect at the lower concentrations of urea.

Average daily liveweight gain (ADG) followed a similar pattern to the intakes of the molasses mixes (Table 2). The relationships for crystalline and granular monensin respectively, being

$$(a)\ ADG = -0.48 + 0.13\ I\ (r^2 = 0.75)$$
$$\text{and } (b)\ ADG = -0.54 + 0.21\ I\ (r^2 = 0.75)$$

where ADG = average daily liveweight gain (KG), and I = molasses intake (kg/d).

Table 1 Intakes of molasses and urea by steers fed a range of concentrations of monensin

Type of monensin	Urea conc. (%)	Intake of molasses (kg/hd/d) Monensin concentration (mg/kg molasses mix) 0	40	80	120	s.e.(mean)
crystalline	3.3	5.5^{a}	5.3^{a}	3.5^{c}	2.7^{d}	
	6.6	4.3^{b}	3.0^{cd}	2.7^{d}	2.6^{d}	0.23
granular	3.9	5.0^{a}	4.0^{b}	3.5^{b}	3.1^{bc}	
	7.7	2.3^{cd}	2.4^{cd}	2.3^{d}	1.8^{d}	0.29

Within monensin types, means with the same superscript are not significantly different (P>0.05)

Table 2 Liveweight gain of steers fed a range of concentrations of monensin

Type of monensin	Urea conc. (%)	Liveweight gain (kg/d) Monensin concentration (mg/kg molasses mix) 0	40	80	120	s.e.(mean)
crystalline	3.3	0.27^{a}	0.25^{ab}	0.02^{bc}	-0.15^{cd}	
	6.6	0.04^{c}	-0.07^{cd}	-0.22^{d}	-0.12^{cd}	0.076
granular	3.9	0.40^{a}	0.40^{a}	0.21^{ab}	0.15^{bc}	
	7.7	-0.09^{ed}	-0.02^{cd}	-0.03^{cd}	-0.25^{e}	0.066

Within monensin types, means with the same superscript are not significantly different (P>0.05)

DISCUSSION

For both forms of monensin, the rate of decline in molasses intake decreased as the concentrations of urea or monensin increased. The inclusion of 120 mg monensin/kg molasses reduced the intake of molasses by 40%, whereas increasing the concentration of urea from 3.3% to 7.7% reduced the intake of molasses by 60%. On this basis, 120 mg of monensin should have about the same effect as 30 g urea. With urea costing $400/t and monensin costing $80/kg, monensin would be costing about 20% less for similar control of molasses intake. Monensin has other advantages, Like other rumen modifiers, monensin improves the efficiency of utilization of dietary energy on a wide range of feedstuffs (Macgregor 1983). Monensin is an effective coccidiostat (Parker *et al.* 1986), and in many areas coccidiosis is a recurring problem in very young weaner cattle. Monensin should therefore prove beneficial in molasses-based diets for weaners.

The steers were fed a fixed, sub-maintenance ration of poor quality hay, and the correlation co-efficients of the regressions of ADG against intake of molasses measure the marginal responses to molasses. The responses of 0.13 and 0.21 kg liveweight gain/kg molasses eaten for crystalline and granular monensin respectively, give an indication of the likely effects of altering the intakes of molasses for cattle of about 300 kg live weight.

At the time this work was carried out the manufacturers of monensin *were* changing from the crystalline form to the granular form, and to a new carrier. We therefore tested both forms of monensin, although only granular monensin is now marketed. With both forms of monensin, an increase in concentration reduced feed intake, indicating that monensin is an effective regulator of molasses intake. However, intakes of the mixtures containing 7.7% urea appear to have been unusually low, and the effect of the monensin was less marked. As could be expected,- monensin concentration had a greater effect in the mixtures with the low urea concentration, since the basal mixture was more palatable. Overall, the two forms of monensin appear to have had similar effects on molasses intake.

The intake of a supplement depends largely on the alternative food sources available to stock, so it is not possible to pre-determine the level of monensin necessary to give a specific feed intake. In practice, intake can be manipulated by increasing *or* decreasing the concentration of monensin until the desired intake is achieved. However, monensin can be toxic, and we have not tested concentrations greater than 120 mg/kg molasses. Care should be taken when preparing the mixture, in order to minimize the chance of overdosing. Thus, with sensible management, monensin can be used as an effective and cheap way to control molasses intake.

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REFERENCES

BEAMES, R. M. (1960). Proc. Aust. Soc. Anim. Prod. 3: 86.

BUBE, A., DAVIS, C.H. and PRESTON, T.R. (1984). In "Ruminant Physiology - Concepts and Consequences", p.186, editors S.K. Baker, J.M. Gawthorne, J.B. Mackintosh and D.B. Purser, (University of WA).

MACGREGOR, R.C. (1983). In "Recent Advances in Animal Nutrition," p.163, editor W. Haresign. (Butterworths: London).

PARKER, R.J., JONES, G.W., ELLIS, K.J., HEATER, K.M., SCHROTER, K.L., TYLER,R. and HOLROYD, R.G. (1986). Trop. Anim. Health Prod. 18: 918.

PRESTON, T.R. (1972). World Rev. Nutr. Dietetics 17: 250.

VEITIA, J.L., PRESTON, T.R. and DELGADO, N. (1972). Rev. Cubana Cienc. Agric. 6: 323.