THE PLACE OF SOLIDIFIED MOLASSES BLOCKS IN THE GRAZING INDUSTRY

C.A. GRAHAM

ICI Australia Limited

INTRODUCTION

Molasses, a liquid by-product from sugar manufacture, is very palatable to ruminants and readily consumed by grazing animals. As well as being palatable, it contains adequate levels of energy, sulphur and other trace minerals (NRC 1964) and is relatively cheap, $23/tonne in 1977, (CSR personal communication). Despite its availability and cheapness, molasses has not been used widely as a stock feed. It was not until a satisfactory low cost method of on-farm feeding was developed (Mutch 1966) that the usage of molasses increased. Between 1967 and 1974 stock food usage rose sharply from 38,000 tonnes to 101,000 tonnes (ABS 1976). This sharp increase in molasses usage coincided with widespread acceptance in Queensland of feeding urea/molasses mixture in roller drum lickers (Queensland Department of Primary Industries 1969 - 70). More recently, increasing on-farm labour costs together with a reduction in the availability of farm labour has stimulated commercial interests in developing molasses blocks as an alternative to liquid molasses supplements.

I would like to describe some experimental work involving molasses blocks in bloat control in Southern Australia and the preliminary work onphosphate molasses blocks in Northern Australia.

Bloat

Bloat is caused by a persistent foam in the rumen inhibiting belching of entrapped gases (CSIRO 1972). It occurs commonly in beef and dairy cattle grazing legume dominant pastures in temperate Australia. The accepted method of control is to remove or prevent foam formation with an antifoaming agent. Twice daily drenching is the most effective method available for dairy cattle. For beef cattle, however, the most practical control measures depend upon free choice systems using pluronic detergent. The effectiveness of these methods has been variable (Langlands and Holmes 1975). The discovery by Laby (1972) of a more effective and palatable detergent than used previously provides the opportunity of improving free choice methods.

I would like to present the results of 12 field trials which were designed to assess the effectiveness of an alcohol ethoxylate detergent (Teric 12A23B) incorporated in a palatable molasses feed block.

Eight grazing experiments were conducted in Victoria between 1973 and 1976 (Graham, Pern and Linehan (1977), Pern, Walsh and Graham (1977) unpublished data) and four in New Zealand during 1976 (Barr and Graham 1977 unpublished data).

Trial procedure

Properties were-selected for trial work on the basis of prior bloat problems. In most experiments a uniform area of pasture was equally divided by an electric fence. In experiments 1-3 and 9-12 the animals allotted to one half were supplied with bloat blocks. In experiments 4-8 placebo and bloat blocks were used in a cross over design. After a period of 1-2 weeks the blocks were weighed and interchanged between groups. The operator responsible for bloat scoring did not know which set of blocks contained the active ingredient.

The blocks were placed in resting areas used by the cattle, unprotected from rain.

Scoring method

The method used has been described by Laby (1972). An animal with only the left flank distended was scored as I, and if both flanks were distended and the animal showed signs of distress it was given a score of 2. All scoring was made daily by the owner or manager of the property on which the experiment was done.

The bloat scores recorded in each preliminary period of 1-2 weeks were used to divide the animals into two groups of equal bloat susceptibility.

Block composition

Although different block formulations were used there was no significant formulation effect. Composition of the blocks are given in Table 1 for completeness.

Formulations l-4 were all tested in experiments l-3 while formulations 2 and 5 (placebo) were used in experiments 4-8. Only formulation 2 was used in experiments 9-12.

TABLE 1 - Percentage composition of solidified molasses blocks

Ingredients	Bloat formulations				Placebo
	1	2	3	4	5
Teric 12A23B	10	10	15	15	0
Molasses	60	63	55	58	68.5
Salt	15	15	15	15	15
Magnesium oxide	15	10	15	10	15
Acetic acid	0	2	0	2	1.5

Bloat Frequency and Severity

The results of 12 grazing experiments conducted in widely varying geographical areas show that bloat blocks consistently reduce bloat frequency (Tables 2, 3 and 4).

TABLE 2 - 1973 Bloat block trials - NE Victoria.

Trial No	Trial Length (Days)	Treatments	No of Animals	No of Deaths	Bloat Frequency % 0	Bloat Frequency % 1	Bloat Frequency % 2	Teric Block Consumption g head^{-1} day^{-1}	Mean Liveweight Change (Kg)
1	46	Control	23	2	48	30	22	-	+13
						NS	***		NS
		Block	23	-	72	28	0	15.0	+30
2	33	Control	10		85	14	1	-	-
						NS	NS		Not recorded
		Block	12		89	11	0	23.6	
3	36	Hay + Mineral Oil	82-168	3	82	17	1	-	-
						NS	NS		Not recorded
		Block	82-106	-	86	14	1	7.4	-

*** $p<0.001$

Table 3

Bloat and Placebo Block Trials

Trial No	Trial Length (Days)	Block Treatments	No of Animals	No of Deaths	Bloat Frequency % 0	Bloat Frequency % 1 or 2	Block Consumption g head^{-1}day^{-1}	Mean Liveweight Change kg
4 Harcourt	45	Placebo	27	-	52	48	68.5	24.2
						***		***
		Bloat	27	-	86	14	106.1	40.0
5 Sale	21 (7	Placebo	7	1	80	20	175.5	10.8
						**		NS
		Bloat	7	-	95	5	404.1	12.1
	(7	Placebo		-	80	20	327.3	-1.7
						**		NS
		Bloat		-	91	9	169.4	5.0
	(7	Placebo		-	95	5	183.7	15.0
						NS		NS
		Bloat		-	95	5	278.7	18.3
6 Yea	28	Placebo	20	-	56	44	120.0	Not recorded
		Bloat	19	-	60	40	133.4	
7 Swift's Creek	42 (14	Placebo	11	-	97	3	259.7	57.7
						NS		NS
		Bloat	11	-	97	3	298.7	64.1
	(14	Placebo		-	100	0	267.5	20.9
						NS		*
		Bloat		-	100	0	196.8	34.6
	(14	Placebo		1 (withdrawn)	99	1	251.3	-5.9
						NS		**
		Bloat		-	100	0	227.9	28.2
8 Sale	28	Placebo	10	-	78	22	161.0	20.5
						***		NS
		Bloat	10	-	99	1	143.0	28.5

*** $p < 0.001$ ** p 0.01   * p 0.05

TABLE 4 - New Zealand Trials 1976.

Trial No	Trial Length Days	Treat-ment	No of Animals	No of Deaths	Bloat Frequency (%)		Block Consumption g head^{-1} day^{-1}	Liveweight Change (kg)	
					0	1 or 2		0-3 wks	0-6 wks
9	42 Winfield	Control	17	3	65	35	-	38.8	72.9
						***		***	***
		Block	17		94	6	121.2	54.1	90.3
10	42 Rakaia	Control	20	1	90	10	-	30.6	62.4
						***		NS	NS
		Block	20		98	2	44.0	28.9	63.0
11	42 Gorrie Downs	Control	8		76	24	-	-	58.1
						*			**
		Block	12		85	15	161.0	-	68.8
12	42 Ashburton	Control	13		53	47	-	-2.7	19.4
						***		**	*
		Block	13		93	7	93.4	10.8	42.3

*** $p < 0.001$ ** $p < 0.01$ * $p < 0.05$

In eight of the 12 trials where moderate to serve bloat occurred block supplementation significantly reduced bloat frequency. Under severe bloat conditions (trials 1, 9 and 12) both bloat severity and frequency were reduced. The almost complete absence of severe bloat in these three experiments is in contrast with the results obtained using capsules (Laby, personal communication) where severe bloat was reduced but not eliminated. The effectiveness of these blocks appears to be due to a number of factors including a high detergent intake. High intakes of alcohol enthoxylate detergents persist in the rumen for long periods. Laby (1972) found that a single dose of 28 g of Teric detergent persisted in the rumen of non-lactating dairy cows for 44.5 hours. Persistence was measured at the time interval between dosing and the re-appearance of bloat. However in most situations a mean Teric intake of 10 g $head^{-1} day^{-1}$ is recommended to prevent bloat (CSIRO 1972). In trials 1-7 the mean teric intake of 21.6 g $head^{-1} day^{-1}$ was twice the recommended level but the mean intake was reduced to 11.2 g $head^{-1} day^{-1}$ in the trials 8-12 by increasing the ratio of blocks to animals (Table 5).

TABLE 5 - Effect of block to animal ratio on Teric consumption.

	Ratio of Blocks to animals	Mean Teric Consumption g $head^{-1} day^{-1}$
Trials 1-7	1 - 5	21.6
Trials 8-12	1 - 10	11.2

It appears that a mean Teric intake of 11 g $head^{-1} day^{-1}$ from blocks is satisfactory in reducing the frequency of bloat. (Tables 3 and 4).

Liveweight

Significant liveweight increases were observed in five grazing trials (1, 4, 7, 9, 11). Part of this increase in liveweight may be due to differences in gut fill brought about by differences in the density of the contents. The rumen content of bloated animals are known to be less dense than non-bloated animals (Laby 1972). It is unlikely that the molasses component of the bloat blocks made any significant contribution to weight gains. Where both placebo and bloat blocks were used, which have a similar molasses content, weight increases were consistently greater for the bloat blocks.

Mortality

10 animals died in the 12 field trials while one animal was withdrawn and treated from Trial 7 because of the probability of death occurring. All the mortalities were recorded in the control groups. In Trial 9 it was found necessary to give 244

bloat drenches in the control group to treat bloat while only one drench was given in the block group.

Proportion of Animals Consuming Bloat Blocks

A successful free choice method of bloat control depends not only upon the level of Teric intake but also on the proportion of animals consuming the supplement and the within and between day variation in intake. In two trials where individual block consumption was measured using the isotope method described by Nolan et *al* (1975) 10 out of 11 animals consumed the supplement in one trial while eighteen out of nineteen animals consumed the blocks in the second trial (Table 6).

TABLE 6 - Assessment of Individual Teric Consumption.

	Teric g $head^{-1}$ day^{-1} 1974(a)	1976(b)
	48.8	36.7
	38.7	30.0
	28.3	23.4
	24.5	15.9
	15.8	15.2
	14.3	13.2
	13.3	12.2
	12.4	11.3
	8.1	11.1
	7.7	10.8
	0	10.8
		10.4
		10.2
		9.1
		8.2
		7.8
		7.5
		4.4
		0
Mean	19.3	12.1
SD	14.5	8.8

(a) Graham, Pern and Linehan (1977)

(b) Trial (8) Pern, Walsh and Graham. Unpublished data.

In both trials more than 80% of the animals consumed an effective or near effective dose level.

Pattern of Consumption

Maintaining adequate concentrations of detergent in the rumen is essential for achieving effective bloat control (CSIRO 1972). The frequency of daily visits to the block will therefore be important in maintaining these levels. Where daily patterns of block consumption were monitored (Table 6) using a surveillance camera it was found that three-quarters of the animals visited the block daily while more than half of the animals made multiple daily visits to the block. The combined findings of a large proportion of animals taking an effective or near effective dose level with a high frequency of multiple visits further suggests that Teric bloat blocks will reduce the incidence of bloat.

SUMMARY

The results of these field trials suggest that Teric Molasses blocks will be useful in reducing the incidence and severity of bloat particularly for beef cattle where no satisfactory alternative method for individual treatment is yet available.

PHOSPHATE SUPPLEMENTS

In northern Australia there is an opportunity to develop a palatable phosphorus supplement for beef cattle. Research work has shown the need for a phosphorus supplement for growing and breeding cattle (Winks et *al* 1976, Holroyd *et al* 1976). However when phosphoric acid was used as part of a liquid molasses supplement animal performance was depressed (Playne 1974). Alternative solid phosphate/salt supplements are not readily accepted by cattle when the P requirement is greatest.

In addition to phosphorus deficiency problems, buffalo fly *(Haemtobia irritans exigua)* increases to significant proportions over the wet summer months causing further economic loss to the beef producer. Methoprene, an insect growth regulator, has been incorporated in salt blocks in USA and successfully fed (Harris, Chamberlain and Frazer 1974) to range cattle to reduce numbers of the horn fly (*H. irritans irritans*), a sub-species of buffalo fly. The possibility of treating both phosphorus deficiency and controlling buffalo fly has wide practical appeal. However the difficulty and cost of demonstrating a definitive field response to both phosphorus supplementation and buffalo fly control in the field is well recognised.

Despite these difficulties several field experiments have commenced to examine the acceptance and variation in consumption of a phosphate molasses block and to assess the effects of methoprene on buffalo fly population and on beneficial insects such as the dung beetle (*Onthophagus gazella*). The initial results on animal acceptance of a dicalcium/molasses block are encouraging.

TABLE 7 - Daily pattern of block comsumption monitored using a surveillance camera.

Cattle numbers	Frequency of visits to blocks — Day 1	2	3	4	5	6	Number of days animals visited the blocks	No. of single visits	No. of multiple visits
1	-	-	-	-	-	-	-		
2	2	2	2	-	2	1	5	1	4
3	1	2	1	2	1	5	6	3	3
4	1	2	4	2	2	3	6	1	5
5	2	-	3	1	2	2	5	1	4
6	1	2	1	1	1	1	6	5	1
7	-	-	-	-	2	2	2	-	2
8	1	-	1	2	3	2	5	2	3
9	-	1	1	-	3	2	4	2	2
10	-	1	1	1	2	2	5	3	2
11	1	3	2	2	2	3	6	1	5
#Unidentified		2		1		1			
Total number of animals visiting blocks daily	## 7	7	9	7	10	10	50	19	31

\# Animals which could not be identified are not included in totals.

\## On day 1 the camera failed between dawn and 9.30 a.m. reducing the total number of possible visits recorded on that day.

Data from Graham, Pern and Linehan (1977)

In a field experiment completed at Department of Primary Industries "Swans Lagoon" Cattle Field Research Station, North Queensland, dicalcium phosphate/molasses blocks (7.2%P) were readily accepted by 20 yearling Brahman X Shorthorn heifers over a 4 month period (Gallagher et *al* 1977). All animals accepted the blocks with individual intakes ranging from 2 - 150 g head^{-1} day^{-1}. There was also a significant increase in plasma inorganic P with supplement intake.

In a pen experiment, methoprene was included in the ration of mature animals at levels ranging from 0.001 mg kg^{-1} day^{-1} steer^{-1} up to 1.0 mg kg^{-1} day^{-1}. Samples of dung were seeded with fly eggs in the laboratory. There was a 97.5% mortality in the buffalo fly larvae at the lowest rate and 100% mortality at 0.025 mg kg^{-1} (Stubbs, personal communication). Where dung beetles were reared in the same dung there was no effect at the 0.025 mg kg^{-1} level. However at 40 times this level (1.0 mg kg^{-1}) there was a 38% reduction in progeny in the first beetle generation. Dung was also collected in the field from grazing cattle supplemented with phosphate blocks containing 0.01% methoprene. There was an 89% inhibition of larvae development compared with the control in laboratory assay. However after 5 weeks this was not reflected in any significant reduction in the adult fly numbers in the field. This lack of response may be due to migration of flies from adjacent, untreated animals swamping the treatment effects. This grazing experiment is continuing. Although it is too early to predict the final outcome of this work it does appear at this stage that the phosphate/molasses block may be a satisfactory P supplement for feeding cattle during the wet season. Further work still needs to be carried out on the extent of migration of buffalo flies between mobs of cattle before making any confident prediction of the likely success or otherwise of suppressing buffalo fly breeding by incorporating methoprene into the supplement. However methoprene blocks are more likely to succeed under extensive grazing conditions where there are large distances between mobs of cattle and where the effects of migration of adult buffalo fly should be minimal.

CONCLUSION

The tritiated water technique developed by Nolan et *al* now provides a more accurate assessment of individual supplement intake, which allows for a better assessment of the potential of free choice systems for the grazing industry. Research into the behavioural aspects of free choice supplements may in the future enable producers to reduce the variation in intake currently being experienced and therefore further improve responses.

REFERENCES

Australian Bureau of Statistics (1975-76) Overseas Trade. Part 1 Exports, 13.

C.S.I.R.O. (1972) - Rural Research 78:2.

Gallagher, B., Holroyd, R.G., Graham, C.A. and Murray, R.M. (1977). *Vet. Pract.* (March) 30.

Graham, C.A., Pern, C. and Linehan, R.L. (1977). *Aust. J. Exp. Agric. Anim. Hus.* (in press).

Harris, R.L., Chamberlain, W.F. and Fraser, D.E. (1974). *J.Econ. En-to.* 67:384.

Holroyd, R.G., Allen, P.J. and O'Rourke, P.K. (1977). *Aust. J. Exp. Agric. Anim. Hus.* (in press).

Laby, R.H. (1972). *Wool Technology and Sheep Breeding* 19:59.

Langlands, J.P. and Holmes, C.R. (1975). *Aust. J. Exp. Agri. Anim. Hus.* 15:5.

Mutch, C.B. (1966). *Qld. Agric. J.* 92:630.

National Research Council (1964). Tables of Feed Composition Publication 1232. Nat. Acad. Sc.:Washington.

Nolan, J.V., Norton, B.W., Murray, R.M., Ball, F.M., Roseby, F.B., Rohan-Jones, W., Hill, M.K. and Leng, R.A. (1975). *J.* Agric. Sci., *Camb.* 84:39.

Playne, M.J. (1974) - *Proc. Aust.* Soc. 10:111.

Queensland Department of Primary Industries Annual Report (1969-70).