BLOAT INVESTIGATIONS

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Frothy bloat may occur in cattle on a wide variety of feeds. It has been observed on green feeds, including clovers, lucerne and other legumes, ryegrass, young green corn, chou moellier and cabbages. It also occurs in grain fed animals under American "dry-lot" conditions. In this country, where the great majority of cases of bloat occur on rapidly growing clover, frothy bloat appears to be the prevalent form.

Although frothy bloat has been known for centuries, the idea that the foam present in the rumen is the cause of the trouble seems to be comparatively modern. Mainly because of the lack of experimental evidence acceptance of this idea has been slow. However, it has received increasing support from recent work overseas (1, 2, & 3) and in New Zealand (4), and it is now becoming recognized as a major cause of bloat in the field.

The mechanism of frothy bloat is deceptively simple. The gases produced by the normal fermentation of the feed in the paunch, and which are normally eliminated by continual belching, are caught up in a strong foam. Cows cannot belch out foam. Hence the gases in the foam are effectively trapped inside the animal. They accumulate as fermentation proceeds, distending the paunch, causing the animal to become bloated. We do not yet know the cause of the foaming, nor do we know how it is related to the many other factors affecting bloat. We are, in fact, very far from understanding the problem as a whole.

If the assumption that frothy bloat is the consequence of foaming is correct, we should be able to do two things:—

1. Relieve bloated cows by breaking down the froth, and
2. Prevent bloat from occurring on potent feed by preventing frothing.

In the case of red clover bloat, which is being intensively studied at Grasslands, we found that we could do both these things by using foam-breaking (anti-foaming) agents. In fact, we found that dosing

with such agents was the only effective and reliable treatment. Further, however, and most important, we found that potent clover was completely innocuous to an animal which had been given an antifoaming agent just before feeding. We had similar, although fewer, results with ryegrass bloat, while Ferguson and Terry have made the same observations with lucerne bloat in sheep.

The use of antifoaming agents for the relief of bloat is by no means new. They figure prominently in treatments used in the 18th and 19th centuries, although their action was not then understood. Although the use of anti-foaming agents as such was recommended in the early thirties of this century (5), Clark of South Africa was probably the first to realise their value. The agents used at Grasslands were various fats and oils, turpentine, and a number of synthetic materials, usually given as drenches. On the basis of effectiveness and harmlessness both to the animal and its milk we considered that, of these agents, vegetable oils, particularly peanut oil, were best for field use. We did not then, and we still do not, maintain that these oils are the final answer. Indeed we confidently expect that better and cheaper agents will eventually be found.

When we found that we could protect stall fed cows with these substances, we naturally looked to see how we could use them to protect grazing cows on the farm.

It is clear, as a first principle, that if we are going to prevent bloat in this way we have to maintain an effective quantity of an antifoaming agent in the paunch of the cow all the time the animal is grazing dangerous pasture. Unfortunately this is not easy, for these substances are rapidly lost from the paunch by passing on down the alimentary tract. To overcome this loss either large doses must be given at intervals or small doses more or less continually. Both from an economic point of view and from the point of view of animal health we consider the second alternative to be the better solution. This method, of course, involves treatment of the animal in the paddock.

In the field, there are two ways of getting the agent into the animal. We may treat the drinking water, or we may apply the agent directly to the feed. Of these alternatives we consider the application of the agent to the pasture as a spray to be the most reliable. Treatment of the drinking water is an attractive proposition. It requires little labour, no capi-

tal outlay and places no restrictions on grazing management. The chief drawback is the variability of the drinking pattern. As a result of this, animals often take in the treated water when they do not need it, and do not drink when they do need the agent. Nevertheless treatment of the water supply is a valuable alternative to spraying particularly on hilly country where spraying is difficult or impossible, and many farmers are using it with reasonable success.

Our first experiments with sprays were carried out last season using dry cows grazing red clover. As sprays we used emulsified peanut oil, emulsified tallow, cream and other agents. The results were excellent, We then tried out emulsified peanut oil sprays with high producing dairy cows on the Massey College 30 acre experimental farm. Again the results were excellent. This season farmers scattered throughout the North Island have tried out oil spraying on their own farms and the reports from them are encouraging. Peanut oil spraying has also been used successfully on clover-dominant irrigated pastures 'in Australia. It appears therefore that spraying with antifoaming agents is a practical field measure for the control of frothy bloat.

The following details are based partly on the results of experiments carried out at Grasslands and partly on the experiences of farmers who have tried spraying for themselves.

THE SPRAY

At the moment emulsified vegetable oil sprays, either peanut oil or raw linseed oil, are recommended. However, other agents may be used in the same way. The emulsified oil may be bought as a ready made concentrate spray, or it may be prepared on the farm, (See Appendix I).

In an emergency cream may be used instead of oil, the dose rate being in ounces of butter fat instead of ounces of oil.

EQUIPMENT

Knapsack spraying is satisfactory if the number of animals is not large. However, normally it is more satisfactory to use a tractor mounted, boom sprayer, of the low-volume type used in weed spraying. The gear pump should not be less than $\frac{3}{4}$in., and it should have a full $\frac{3}{4}$in. inlet hose. This ensures a good over-

flow through the reduction valve, which helps to keep the spray in the main tank agitated. The boom should not be less than 9ft. 6in. long, and the nozzles should be of the fan type, of size 32-46m. The boom should be mounted on the rear of the tractor if the ground to be sprayed is at all hilly, to minimise wheel slip. It is an advantage to angle the nozzles slightly from the vertical by rotating the boom about 15° in its mounting. A quick cut-off boom control valve is an advantage.

Even if a tractor-mounted spraying outfit is used, it is desirable to have a knapsack available for spraying portions of the paddock not reached by the boom, e.g., under fences or on steep faces. Alternatively a normal spraying lance on a'hose could be attached to the pump to reach these areas.

APPLICATION

There are two general methods of applying these sprays :-

1. Total area spraying, and
2. Strip spraying.

By far the more reliable of these for general use is total area spraying, since -the cows are always on sprayed pasture and have no option in taking in the oil. In this method, the whole area to be grazed by the cows in 24 hours is sprayed just prior to turning in the animals, the rate being not less than 3 oz. of oil per cow (1 gallon contains 160 fluid oz.). The rate of oil per acre will depend, of course, on the density of the feed, while the actual volume of spray made up will depend on the performance of the spraying equipment used.

There are four main precautions which **must** be taken in using this method:-

1. The area to be grazed in 24 hours must be judged **conservatively.** If too large an area is allowed, the oil will be spread too thinly and insufficient may be taken in by individual cows.

2. There must be no access to unsprayed pasture. The animals must be confined to the sprayed area by means of an electric fence. Care should be taken to see that the cows cannot reach under the fence to unsprayed pasture.

3. The area should be sprayed as evenly as possible.

4. There should be no back grazing-three day old regrowth can be highly dangerous.

In general, it is an advantage to give the sprayed area in 2 or 3 breaks to minimise skimming of the tops.

In the second method, a strip of pasture is sprayed at the rate of not less than loz. of oil per cow and the animals are" allowed to graze it. When they have finished, they are then allowed to break graze unsprayed pasture. This method gives protection for a limited time only, and if the clover is highly potent fresh sprayed strips may be required-every four hours. Under some conditions, however, it is possible to obtain control with one sprayed strip given after each milking. In this method it is of primary importance that each cow should take in its fair share of sprayed pasture. If it does not it will be only poorly protected, or not protected at all. Adequate foot room must be available during the grazing of the sprayed strip, while it is an advantage to offer the strip when the cows are hungry.

CONTROLLING AN OUTBREAK OF BLOAT

In bringing an outbreak of bloat under control, heroic measures may be necessary:

1. The grassiest paddock on the farm must be used.
2. The area to be given in 24 hours should be a little less than that normally grazed in a day, so that grazing will be restricted to some extent.
3. The selected area should be sprayed at a high rate-6oz or more of oil per cow.
4. Any bloated cows, and in any case the worst bloaters, should be drenched before being put on the sprayed area.
5. The grazing rate should be controlled by giving the area in a number of breaks.

In general, the aim is to get the cows settled down again as rapidly as possible. By the second or third day, it should be possible to start reducing the rate of spraying and the number of breaks given, as well as. increasing the total area back to normal. It should not be necessary to drench the cows again before grazing after the first day.

Sprayed pasture may be a little unpalatable at first, but the cows quickly become used to it.

In no case so far has taint occurred in the milk or cream following grazing of sprayed pastures even when rates as high as 10 fluid oz of oil per cow per clay have been used. If taint does occur the possibility of contamination of the milk in the milking shed should be considered. ,

Oil sprays appear to stand up to a certain amount of weathering. However, it is not advisable to spray more than 36 hours' feed in advance.

Labour requirements and costs have been reduced by some farmers by splitting the herd into bloaters and non-bloaters. These two groups are grazed separately, spraying being carried out only for the bloaters. There is, of course, an element of risk in such a procedure.

FAILURES

If spraying does not control an outbreak of bloat even when high rates of oil are used, the first points' to check are the efficiency of spraying and the quality of the spray. A poor emulsion can only result in uneven distribution of the oil. In the strip spraying method it should be noted whether any cows are refusing to eat the sprayed pasture or are being driven off by "boss" cows.

Despite careful attention to spray and spraying certain cows may still bloat. These may be chronic bloaters. Spraying is intended to control "uncomplicated" acute frothy bloat whereas other factors may be operating in cases of chronic bloat, and may require separate treatment. Three common causes of this type of bloat are excessive nervousness of the animal, a degree of hypocalcaemia, or some form of digestive complaint. Calcium borogluconate treatment, or a magnesium sulphate drench, are worth trying in such cases.

CONCLUSION

Although spraying with antifoaming agents appears to be an effective control measure for frothy bloat some time must elapse before its value as a general farm practice can be judged. Experience is-too limited yet, and many problems have still to be solved. From an economic point of view it is already clear that spraying is capable of paying for itself in the case of dairy herds by the maintenance of production, apart from reduction or elimination of animal losses. However any assessment must also take into consideration the obvious advantages of bloat control-the reduction of worry, the fact that a farmer is able to handle his pastures to best effect, his ability to get on with other farm work, and so on-which are not easy to evaluate. Finally it must- be emphasised. that spraying is only an emergency measure. It does not substitute for good pasture management.

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APPENDIX 1

The following method of preparing emulsions is being used at Grasslands at present. It is simple and reliable, and has been found suitable for routine farm use.

PRINCIPLE

The emulsion is formed by the intimate mixing of oil and water as they pass through the filter, gear pump and relief valve of the standard low-volume spray pump. The process is facilitated by feeding the oil directly into the inlet (intake) hose, and by the use of an emulsifying agent to reduce the oil-water surface tension.

EQUIPMENT

The basic equipment is a standard low-volume spraying outfit mounted on a tractor. A small auxiliary tank to hold the oil before emulsification is fixed on top of the main spray tank. This oil tank is drained through a short hose and a control valve into a "T" pipe. inserted in the inlet hose. It is an advantage to use clear or semi-transparent plastic hose for the oil line. The oil feed valve should preferably be a cock although block valve or gate valve will do as long as they do not leak. To protect the pump from any foreign matter in the oil a line filter should be used instead of a foot filter and this, of course, will be between the "T" pipe and the pump.

No other modifications are necessary if the equipment has the usual return (overflow) hose from the relief valve back to the main tank. However, if a pump with a built-in relief valve and return is used, a second "T" pipe will be required, between the relief valve and the boom cut-off valve. During emulsification the mixed spray will then be returned to the main tank through a valve and hose connected to the side arm of the second "T".

EMULSIFYING AGENTS

The stability of the emulsions produced by this method depends mainly on the type and quantity of the emulsifying agent used. When the spray is to be used immediately, low concentrations-l to 2 fluid oz per gallon of oil-of relatively poor emulsifiers such as Teepol or Lissapol NX (which we prefer at. Grasslands)

may be used. Larger amounts-4 fluid oz per gallon of oil-will be needed if the spray is to be kept overnight. For more permanent emulsions better emulsifiers such as the Lubrols, the methyl celluloses, or glyceryl monostearates should be used. The following table gives an indication of typical rates.

Typical Emulsifiers for Vegetable Oil Sprays

Agent	Nature	Rates per gallon of oil	Notes
Teepol	Sulphated fatty alcohol	1-4 fl. oz.	1
Lissapol NX	Polyethylene glycol derivatives	1-4 fl. oz.	2,4
Lubrol W		2-8 oz.	2,5
Lubrol Mo		2-8 oz.	2,5
Cellophas A	Cellulose derivatives	3-5 oz.	2,5
Cellophas B		3-5 oz.	2,5
Glyceryl monostearate and soap	Mixture of glycerol stearates plus 2-5% soap	8-14 oz.	3,5

Notes:
1. Product of Shell Co. Ltd.
2. Product of Imperial Chemical Industries Ltd.
3. Product of Abel's Ltd.. Auckland.
4. There are two other grades of Lissapol-N and N300 containing the same active principle but at lower concentrations. Lissapol N.300 may be used at the same rate as Lissapol NX, but Lissapql N should be used at about 3 times this rate.
5. These agents must first be dissolved in a quanity of warm water. When in solution, they may be diluted with cold water.

Other emulsifying agents may be- used, but care must be taken to select one that is not toxic to animals, and that will not affect the palatability of, herbage on to which it is sprayed.

PROCEDURE

Although a usable emulsion is formed immediately it is improved by being passed through the pump two or three times. However gear pumps have only a limited output-about 5 gallons per minute for a standard $\frac{3}{4}$in. pump running at 900 R.P.M., with a $\frac{3}{4}$in. inlet hose. To keep this extra mixing time to a minimum, the total volume of constituents is kept small at the start, a concentrated emulsion being made first. This concentrate is then diluted as required. The actual steps are as follows:-

(a) The boom cut-off valve and the oil feed valve are shut. The oil to be emulsified is placed in the oil tank and the water plus the emulsifying agent in the main tank. The volume of water used at this stage is 2-4 times that of the oil. There is no advantage in using

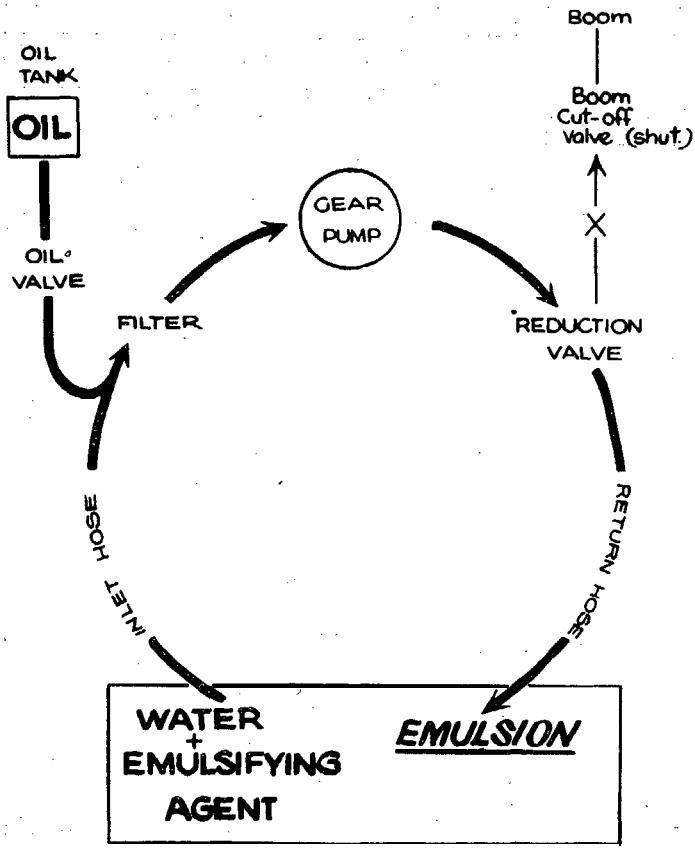

Figure 1.

Flow diagram for malting oil emulsions with modified low-volume spraying equipment.

warm water-in fact, unless an adequate amount of emulsifying agent is used, warm- water may be a distinct disadvantage, since it promotes the coalescing of the oil droplets. However the chill should be taken off very cold water.

(b) The pump is started. This will cause water (and the dissolved emulsifying agent) to begin circulating from the spray tank, through the filter, pump and relief valve back to the tank again (see Fig. 1). The pressure showing on the gauge should be adjusted to not less than 40lb. per sq. inch.

The oil feed valve is now opened carefully and the oil run in slowly, taking not less than 2 minutes for

each gallon of oil. As soon as the oil starts running in a milky emulsion should commence flowing out of the return hose.

(c) Immediately all the oil has been run in the oil feed valve is shut. The pump is now allowed to circulate this concentrated emulsion for a short time, say 3-5 minutes.

(d) The concentrated emulsion is diluted as required,. This may be done by adding the remaining volume of water ready measured out in a separate container, or by using a hose to fill the main tank up to a predetermined mark.

If the pump is left running while the tractor is driven to the paddock, the diluted spray will be well mixed.

DISCUSSION

Q. (Mr. Holden) I am speaking on behalf of some farmers in the Rotorua district who between them lost 243 cows with bloat last season. My first question is:
What size nozzle do you suggest for spraying pasture ?

A. We have found a 39M spray nozzle has given good results, with a pressure of 35 pounds.

Q. My second question concerns pasture management practices. These farmers have tried various pasture management practices without sucess to cope with bloat.
What management practices do you suggest?

A. (Dr Sears). The main thing is to keep the grass growing, so that the pasture is not clover dominant.

Q. While I appreciate the work being done at Grasslands on bloat investigation we do not appear to be getting anywhere at finding the cause of the trouble.

A. As I said in the paper, spraying is only a palliative, and every effort is being made to get at the cause.

Q. Has the feeding of a ration of hay each morning been tried, and is this a help to alleviate the trouble ?

A. We have tried this, with no effect.