Bloat in New Zealand Cattle

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Background

New Zealand's two main islands extend from latitude 34° 50' S to 47° S. Slightly more than half of its 26 million hectares are in exotic or native pastures. The land is mountainous–only a quarter is below 200m in altitude–but a wide variety of terrain is farmed from rich alluvial flats, through rolling hills, to finely dissected ranges. Compared with its human population of about 3.1 million, there are 3.1 million dairy cattle, 6.5 million beef cattle and 55.3 million sheep. Goats are unimportant economically but are a noxious pest on undeveloped land.

Ruminants are not housed indoors at any time of the year in New Zealand, although winter feeding pads may be used. Feedlots are rare and the units very small by American standards. The basic management system is to graze the animals on pasture all the year round, providing supplementary feed–hay, silage, crops–during periods of pasture shortage. The main pasture species are ryegrasses (*Lolium* spp.) and clovers, especially white clover (*Trifolium repens*); other grasses include browntop (*Agrostis tenuis;* on hill country), paspalum (*Paspalum dilatatum*) and kikuyu grass (*Pennisetum clandestinum*) (both important species in the north of the North Island), cocksfoot (*Dactylis glomerata*), fescue (*Festuca arundinacea*); and other legumes include red clover (*T. pratense*), subterannean clover (*T. subterraneum*), strawberry clover (*T. fragiferum*) and *Lotus* spp. Lucerne (alfalfa) is being used increasingly both as pure stands and in mixed pastures. Maize is also increasing in use, both as a standing crop, and as silage. The mainstay of New Zealand farming remains, however, this mixed grass/legume pasture, in which nitrogen is supplied by the legume, while phosphorus, potassium and lime are applied as needed.

Bloat in New Zealand

Bloat in New Zealand is a disorder of grazing animals: feedlot bloat is virtually unknown. By nature it is legume (frothy) bloat, only a minor proportion of cases being due to other causes, e.g., hypocalcaemia.

Bloat occurs in New Zealand most frequently in dairy cattle, in which it is a common disorder. By contrast, it is an uncommon disorder in sheep, which are considered to have a low susceptibility to bloat. In assessing differences between species, however, two factors must be taken into account–recording and exposure. Whereas records of bloat as a cause of wastage in the national dairy herd have been kept for over 30 years by the New Zealand Dairy Board (NZDB), there are no comparable records of wastage from bloat in the national beef herd or the national sheep flock. The importance of bloat as a disorder of beef cattle and sheep can be judged only from occasional surveys, usually limited to a specific district. Exposure to the risk of bloat is usually greater for dairy cattle than it is for beef cattle or sheep. Dairying tends to be carried out on flat, fertile land with a rainfall of about 120 cm/year. These areas are intensively farmed to produce dense, lush pastures with a high content of white and red clovers, or lucerne. Beef and sheep farming, on the other hand, are carried out under a wide variety of circumstances, commonly on less fertile, drier land, and often with feeds or pasture species which don't cause bloat. However, where beef cattle are raised under intensive farming conditions on bloat-provoking feed, e.g., lucerne, severe outbreaks of the disorder can occur. By comparison, lambs can be raised on pure white clover pastures apparently with impunity.

Bloat in New Zealand Dairy Cattle

According to the N.Z. Official Year Book (1975), the "average" N.Z. dairy farm has an area of 63 hectares and a herd of 108 cows. Rather bigger enterprises are common: nearly 20% of the holdings with 10 or more cows have herds of more than 200 cows. The predominant breed is the Jersey (74% in 1970-71), although the proportion of Friesian cattle (then 22%) is increasing. Ayrshire (3%) and Shorthorn cattle (1%) lead the minority breeds.

1. *Incidence:* Most of the available data concerns losses by death rather than the actual incidence of bloat. From those surveys which do include incidence, it is clear that, whereas up to 90% of the herds in a district may experience bloat, and most animals in an individual herd be afflicted, the losses by death are not usually high. Deaths in an individual herd may exceed 15%, but the regional average death rate is seldom higher than 2%. In mild outbreaks, no deaths may occur, and in potentially dangerous outbreaks, deaths may be reduced or prevented by effective treatments or prophylaxis. Average death rates are, thus, not a precise index of the incidence of bloat, but they can be used to deduce general characteristics of its incidence.

In the 20 years between 1940 and 1960, the annual national average loss by death from bloat increased from 0.22% to 0.74%. This has been associated with the improvement of old pastures and the breaking-in of new land, especially in the centre of the North Island. Since then, the figure has fluctuated between 0.3 and 1.2%; in 1975 it was close to 0.6%.

There is a considerable regional variation in the average death rate. It is usually higher in the North Island than in the South Island; and within both islands, bloat is more prevalent in some districts than in others. In a year when serious outbreaks were widespread (1963), the lowest regional death rate was 0.6%, the highest 2.5% and the national average 1.2%; while in the following year, when bloat was comparatively mild, the figures were 0.3%, 1.0% and 0.4%, respectively.

Seasonal peaks of bloat incidence occur, one in spring (September, October) and another in autumn (March, April), the spring peak usually being the greater. As would be expected, the timing of these peaks depends on the locality and the weather in a given year. The decline of bloat during summer coincides with the grasses going to seed, high soil temperatures and dry conditions; it reappears with the flush of growth in the early autumn. However, there are localities where the risk of bloat remains high for most of the year.

2. *Animal factors.* Wastage from bloat decreases with age; young dairy cattle are more susceptible than older, unlike the more general pattern of disease wastage. This is shown in Table 1.

Table 1

A Survey of Disease Wastage by Age in Dairy Cattle

Age:	2 yrs.	4 yrs.	6 yrs.	8 yrs.
Bloat	1.71%	0.82	0.66	0.65
Milk Fever:	0.03	0.08	0.24	0.28
Mastitis:	0.38	0.75	1.22	1.67
Low fertility:	2.58	3.00	3.79	5.92
Total disease wastage	6.76%	6.76	8.37	11.35
Total cows in survey	76,484	44,818	29,340	18,101

*Data from NZDB Survey of Herd Wastage, 45th Farm Production Report, 1968-69 season.

Bloat occurs in all dairy breeds. However, Jersey cattle appear to be more susceptible than Friesian or Ayrshire cattle (NZDB Surveys 1964-5, 1971-2). In addition, there is clear evidence for high susceptibility in certain families of cattle. Both observations point to a genetic component in determining susceptibility as was first postulated by Knapp, Baker and Phillips (1).

3. *Pasture factors.* Most commonly bloat occurs on immature, fast-growing, legume-dominant pastures. The legumes most frequently involved are white and red clovers, less frequently subterranean clover. Bloat on lucerne is an increasing problem, reflecting in part the increasing use of this species in the North Island. Deaths from bloat also occur on pure grass stands that have been heavily fertilized with nitrogen. In general, practices which improve pasture growth–irrigation, application of fertilizers, improved drainage, and so on–will tend to increase the risk of bloat.

Bloat Prevention and Treatment

1. *Pasture management.* Bloat is less likely to occur on mature grass-dominant pastures. Farmers are therefore advised, as a first line of defence, to provide such feed for their animals. However, to maintain a continuous supply of mature, grass-dominant pasture in the amounts needed for high production is not easy. The task becomes more difficult again when large areas of uneven terrain are involved; pasture characteristics will vary with localised variation in soil, water supply, exposure, elevation and aspect. While sound in theory, the goal is thus not always achievable in practice. It is not surprising to find that there are often occasions on intensively farmed units when no "safe" mature grazings are available and all reserve feedstuffs exhausted. Other measures must then be used.

2. *Anti-foaming Agents.* Recognition that legume bloat was essentially a problem of foaming of the rumen contents quickly led to the use of anti-foaming agents (AFA) as rational and specific agents for the prevention and treatment of the disorder. AFA and detergents (the latter appear to act by mobilizing natural AFA in the ruminal digesta) are widely used in New Zealand. The most common AFA are medicinal paraffin and tallow. The detergents include Pluronic-type materials equivalent to L62 and L64 (polyoxypropylene-Polyoxyethylene block polymers; Wyandotte) and generally similar to Poloxalene, Marlophene 89 (a nonyl phenolethoxylate; Chemische Werke Huls), and alcohol ethoxylates (Polyethoxy alkyl ethers; Imperial Chemical Industries). Several methods are in use for the routine administration of these materials as prophylactics.

Drenching. Drenching with detergent solution is the most reliable system at present available. The dose is of the order of 5-8 ml diluted 1:2 or 1:3 in water, and provides protection for some 10-18 hrs. The recommended practice is to drench at each milking, i.e., twice daily, either in the milking shed or in a drenching race nearby. A standard automatic drenching gun is used, with the reservoir sliding along a wire above the animals. Dairy cattle quickly accept routine drenching; indeed, they will co-operate by turning their head into the correct position as the operator approaches. Medicinal paraffin (60-120 ml) is also administered in this way, but the persistence of reliable protection is only about 4 hrs.; it is useful when bloat is restricted to the period immediately after milking.

Pasture-spraying. In this system, AFA is sprayed onto the pasture and is ingested by the animal during grazing. It is well-suited to both lactating and dry stock, to dairy herds and to intensively grazed beef herds. The AFA–medicinal paraffin or tallow–are usually applied as an emulsion in water, using a tractor-mounted, low-volume spraying unit with a boom. Self-emulsifying mineral oil preparations are sold for this purpose but are not superior to sprays prepared on the farm from the basic ingredients. The recommended procedure is to estimate the area of pasture to be offered to the herd in 24 hrs. and to spray this at the rate of approximately 90g AFA per cow. The cattle must be contained on the sprayed area, electric fences being used if needed. They are not allowed access to unsprayed pasture, or to regrowth more than 72 hours after grazing. In normal weather, up to three days rations may be treated at a time–the spray, once dried, will withstand moderate rain or dew.

Treatment of drinking water. In this popular system the active agent–usually detergent–is added to the drinking water. It is basically simple, requires little labour and is applicable to all kinds of stock. However, it cannot be used when animals have access to streams, ponds, irrigation races; in particular, it suffers breakdowns when the weather is wet, or heavy dews occur, at which times drinking is light. Several methods of water treatment are in use. The simplest is to pour a strong solution of degergent directly into the trough, with stirring, to give an initial detergent concentration of about 0.1% (alternatively, 3 ml of detergent per animal may be added). With this method, however, the first cows to drink will ingest too much detergent, the last too little, because the detergent is progressively diluted by water from the supply replacing that which has been drunk. Various methods have been devised to improve the dosage characteristics. The best, but also the most expensive, is a simple metering pump, activated by water flow, which adds detergent to the water supply itself at a controllable rate; the concentration in the trough then remains constant. This method has two other advantages. First, it can service several water troughs simultaneously–all water to which the animals have access must be treated, including that in the milking yard troughs. Secondly, it functions continuously–when detergent is added directly to the trough, it has to be replenished at least twice a day.

Flank treatment. In this, the most commonly used system, AFA–usually heavy medicinal paraffin oil–is applied directly to the flank of the animal. Hopefully, the animal will then lick it off and so gain protection. The oil may be daubed on with a large brush, or it may be squirted on by an automatic dispenser triggered by the passing of the animal. The method is messy and only moderately reliable, but has been found useful when bloat is mild. Not all animals can withstand this system; skin reactions are not uncommon, and some animals have their flanks licked raw.

3. *Methods and materials not generally used.* It is not common for New Zealand dairy cattle to be fed supplements routinely. When offered supplements in the milking bail, a large proportion of cows will take them only irregularly, or not at all. Supplements are thus not a suitable vehicle where, as in the case of bloat prevention, a high degree of regularity of administration is needed. Licks–blocks or drums–are likewise not fully reliable administration systems under New Zealand conditions and are little used. As to materials, Poloxalene, although effective, is not widely used because of its high cost. Antibiotics, after a brief spell of popularity, have not been used for bloat control for many years.

4. *Future methods of bloat prevention.* The rising costs of labour, transport and materials–especially materials based on the petroleum industry–have caused steep increases in the cost of bloat prevention. If the recommended drenching procedures are used, the farmer will have to spend as much as $NZ10/cow/year on materials alone. (The net return for butterfat–the price paid by the factory to the farmer–is $NZ1.32/kg, and the cost of a good dairy cow at the start of the season, $NZ90-95 for a Jersey, $NZ100-105 for a Friesian; figures, July 1976.) To reduce expenditure on bloat prevention many farmers are taking risks by under-dosing, by using cheaper, but less reliable systems, by shortening the period during which prophylactic measures are used.

Several lines of research being undertaken in New Zealand and Australia have, as one of their aims, reduction of the cost of controlling bloat.

Medicinal prophylaxis. The search for new materials, formulations or systems with better cost:effectiveness ratios continues. Three examples are:

(a) A systematic study of alternative detergents is being carried out in Australia by Dr. R.H. Laby of CSIRO (2). This has led to the use of alcohol ethoxylates for bloat prophylaxis.

(b) Several kinds of depot, which remain in the rumen and slowly release detergent, are being developed. They range from plastic capsules filled with a gel containing enough detergent to provide protection for some three weeks, to simple gel drenches which may provide protection for only two or three days. Again, most of the basic work has been carried out in Australia (2).

(c) The use of atomised AFA (medicinal paraffin oil or melted tallow) applied as a mist is being developed in New Zealand as an alternative to pasture-spraying with AFA emulsions. This new system is effective and greatly reduces labour costs. Capital costs are higher in that the machine–a self-contained, horticultural "mist-module"–is more expensive than a standard spraying outfit.

Agronomic measures. It has been found that legumes which do not cause bloat commonly contain protein precipitants, usually condensed tannins (3). As a result of interaction of precipitant and protein in the animal, the amount of protein remaining in solution is reduced to a level insufficient to give rise to bloat foams. Two possible ways to exploit this finding are being examined. The first is to use existing tannin-containing plants such as sainfoin *(Onobrychis viciifolia)* and *Lotus* spp. These may be simply used as safe grazing, be offered as a break before the animals graze conventional legume pastures, or be introduced as a new component in those pastures. The second possibility is to increase the tannin content of conventional legumes that do cause bloat. White and red clovers and lucerne contain very little tannin–it is present only in the flowers of white clover. To increase the tannin content of these species is a complex scientific challenge, involving plant biochemists, geneticists, cytologists and agronomists.

Animal breeding. Another long-term solution that is being actively examined is that of breeding strains of cattle that are less susceptible to bloat (4). Cattle exhibit a wide range of susceptibility, from animals which bloat frequently and severely, to those that bloat little, perhaps never. There is good evidence that susceptibility is in part genetically controlled, and initial experiments are aimed at determining heritability, the likely rate of change of susceptibility in successive generations, and other basic genetic data. As part of this project, genetic markers suitable for use in breeding programmes are being sought; the protein composition of saliva may well be such a marker (5).

5. *Treatment.* The standard treatment for bloated cattle is to drench them with either 15-30 ml of detergent as a strong solution, or 120 ml of medicinal paraffin oil. Rumenotomy is still performed on dangerously bloated animals that have collapsed. A drench of detergent or oil is given following rumenotomy, both to assist clearing of regurgitated digesta, and to prevent further bloating for a period.

Envoi

It may seem a contradiction that, despite many years research and the evolution of effective measures of control, bloat remains a problem both in New Zealand and Australia. Several factors would seem to contribute to this situation. The risks being taken to reduce the cost of prophylaxis have already been mentioned. In addition, more animals are now exposed. This is not so much because of increasing cattle numbers (the numbers of dairy cattle are falling, of beef cattle, rising) but because of continued pasture improvement, including hill pastures, and the introduction of more vigorously growing pasture strains. Lastly, there is the element of unpredictability. Generally, the farmer does not know for certain that his pastures are dangerous until bloat actually occurs. And once he starts using effective prophylaxis, he can't be certain when he can safely stop. Inevitably, misjudgments will occur. A simple method for accurately predicting the hazard of bloat on a particular pasture or feed is urgently needed.

References

1. Knapp, B.; Baker, A.L.; and Phillips, R.W.: Variations in the occurrence of bloat in the steer progeny of beef bulls. J. Anim. Sci. 2, (1943); 221-225. - 2. Laby, R.H. Surface active agents in the rumen. Digestion and Metabolism in the Ruminant. Ed., McDonald, I.W.; Warner, A.C.I. Univ. of New England Publishing Unit, Armidale, Australia (1975); 537-556. - 3. Jones, W.T.; Anderson, L.B.; and Ross, M.D. Bloat in cattle XXXIX. Detection of protein precipitants (flavolans) in legumes. N.Z.J. agric. Res. 16, (1973); 441-446 - 4. Reid, C.S.W.; Clarke, R.T.J.; Cockrem, F.R.M.; Jones, W.T.; McIntosh, J.T.; Wright, D.E. Physiological and Genetical Aspects of Pasture (Legume) Bloat. Digestion and Metabolism in the Ruminant. Ed., McDonald, I.W.; Warner, A.C.I. Univ. of New England, Armidale, Australia (1975): 524-536. - 5. Clarke, R.T.J.; Jones, W.T.; Reid, C.S.W. Bloat in Cattle XLI. Proteins of saliva as possible genetic markers in breeding programmes to reduce susceptibility in cattle. N.Z.J. agric. Res. 17, (1974): 411-416.

Recent Reviews

Leng, R.A.: McWilliam, J.R. (Eds) Bloat. Reviews in Rural Science, No. 1. University of New England, Armidale, Australia (1973) 103 pp. - Clarke, R.T.J.; Reid, C.S.W. Foamy Bloat of Cattle. A Review. J. Dairy Sc. 57, (1974): 753-785. - Howarth, R.E. A Review of Bloat in Cattle. Canad. Vet. J. 16, (1975): 281-294.