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primefacts
PROFITABLE & SUSTAINABLE PRIMARY INDUSTRIES www.dpi.nsw.gov.au
NOVEMBER 2006 PRIMEFACT 330 (REPLACES AGFACT A0.9.53)

Grain poisoning of cattle and sheep

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Introduction

Grain poisoning, also known as **grain overload or lactic acidosis**, is usually the result of stock consuming large quantities of grain or pellets to which they are unaccustomed. Pasture-fed cows or feedlot cattle not yet adapted to grain may become acutely ill or die after eating only moderate amounts of grain, whereas stock accustomed to diets high in grain content may consume large amounts of grain with little or no effect.

Some circumstances under which grain poisoning can occur include:

- accidental access to grain stores;
- stock access to stubble paddocks containing excess grain after harvest;
- stock access to standing crops;
- cattle and sheep on feedlot rations without proper introduction;
- grain feeding during drought without proper introduction.

Cause

Grain and finely ground carbohydrate (such as is found in pellets) is rapidly fermented by bacteria in the rumen, producing large quantities of lactic acid, which lowers the pH in the rumen. The build-up of acid has the following effects on the animal:

- There is a decrease in the numbers of useful bacteria in the rumen and an increase in the amount of acid-producing bacteria (causing further build-up of acid in the rumen).
- Rumen contractions cease.
- Lactic acid draws fluid into the rumen from the tissues and blood, resulting in dehydration.
- In severe cases, the blood may become more acid, resulting in heart failure, kidney failure and death.
- Lactic acid can cause severe damage to the rumen wall (rumenitis), enabling fungal or bacterial invasion of the body. This can result in peritonitis or liver abscess even up to a week after grain poisoning.
- Laminitis, a painful inflammation of the hoof, may occur, resulting in severe lameness.

Grains with a higher fibre content, such as oats and sorghum, are safer to feed than, for example, wheat and barley, since the fibre slows the rate of digestion.

Cracking grain increases the rate of digestion of the starch and consequently may increase the risk of grain poisoning.

Any factor that causes variation in the intake of grain, or variation in the availability of carbohydrate, may lead to grain poisoning problems. For example, an unpalatable additive or inclement weather may put cattle off their feed on one day, but then they gorge the next day.

The effects of grain poisoning may be worsened if the animal is also suffering from cold stress. It is a wise precaution to increase the proportion of roughage fed during particularly cold weather.

Other sources of carbohydrates, such as apples, grapes, bread, baker's dough and incompletely fermented brewer's grain, can also cause poisoning if eaten in excess.

Signs

The severity of the signs of grain poisoning will depend on the quantity of grain eaten and the degree of adaptation of the animal to the grain diet. A range of signs is frequently seen in the condition.

Mildly affected animals have a reduced appetite, and may appear quiet and depressed. The muscular contractions of the rumen slow down and there may be abdominal pain. Diarrhoea is also a common sign of mild acidosis.

A more severely affected animal is obviously sick. Profuse scouring of pale, smelly faeces is evident. As grain poisoning becomes worse, the heart and respiration rates increase, while body temperature remains normal or is below normal. Rumen contractions may cease altogether and the animal may appear bloated.

Very severely affected animals usually remain recumbent, with their head turned back against their side. Once an animal is unwilling or unable to rise, it is likely to die within 24 hours. Sometimes animals appear to recover, but relapse after 3–4 days, usually due to secondary infections of the rumen. They may die from peritonitis as a result of damage to the gut. Pregnant animals may abort 10–14 days after recovery.

Prevention

Careful introduction of grains

Good security of grain stores and standing crops is essential in order to prevent accidental poisoning. If you are intending to turn stock onto stubble, it would be a wise precaution to feed some grain beforehand, so that the rumen bacterial population becomes adapted to grain. Guidelines for safe introduction to grain (see Table 1) should be followed.

When stock are fed grain or any feed that has a high carbohydrate content, the feed must be introduced gradually so that the animal's rumen has time to adapt to the increasing levels. There should also be a minimum of 10%–20% roughage in any ration.

During the introductory phase to grain feeding, animals should be closely monitored. Diarrhoea is often the first sign of mild grain poisoning, and if this is seen in a number of animals, the proportion of hay in the ration should be further increased.

Some grains, for example lupins, are safer to feed than others. Similarly, it is safer to feed oats, which have a higher ratio of fibre to starch than does wheat.

When changing between different types, or even batches, of grains, and especially when changing between batches of pellets, the new feed should be introduced by 'shandying' it with the old and gradually increasing the proportion of the new feed over about 7 days.

Paddock situation

A typical introductory regimen to drought grain feeding in a paddock situation for sheep or cattle is given in Table 1.

Table 1. A typical introductory regimen for increasing grain content in the rations of sheep and cattle in a paddock feeding situation

Day	Amount of hay	Cereal grain (g/hd/day)		
		Sheep (40 kg wether)		Cattle
1–2	To requirements, then grain	50	Daily	1000
3–4	Decrease hay fed	100	Daily	1500
5–6	Decrease hay fed	200	Daily	2000
7–8	Decrease hay fed	300	Daily	2500
9–11	Decrease hay fed	370	Daily	3000
12–14		430	Daily	Increase by 500 g every second day until required level is reached.
15–17		860	Every second day	
19–22 and thereafter		1290	Every third day	

Production rations

When animals are introduced to a high-grain diet, they should be started on a ration consisting primarily of hay, with the percentage of grain being gradually increased over 2–3 weeks.

A typical introductory regimen for introducing sheep or cattle to a complete diet of grain and roughage is given in Table 2.

Table 2. A typical introductory regimen for increasing grain content in a complete ration for sheep or cattle

Day	% in ration	
	Cereal grain	Hay
1–5	20	80
6–10	40	60
11–15	60	40
16–20	70	30
Final ration	80	20

Including lupins in the ration

Alternatively, lupins may be used to introduce sheep to a complete ration with high levels of grain. The high fibre content and low starch levels in lupins make them extremely safe to feed to ruminants without the risk of acidosis. **The lupins must be fed whole or cracked, but not ground, as grinding will increase the risk of grain poisoning.** The high protein and energy levels in lupins also make them an ideal feed for inclusion in any ration. A typical introduction to a feedlot ration using lupins is given in Table 3:

Table 3. A typical introductory regimen for increasing grain content using lupins in a complete ration for sheep

Day	% in ration		
	Lupins	Cereal grain	Hay
1–5	80	0	20
6–10	60	20	20
11–15	40	40	20
16–20	20	60	20
Final ration	0	80	20

Large quantities of ground lupins fed to cattle can result in deaths from acidosis, and care should be taken in implementing lupin-based feeding regimens with cattle.

Using feed additives to reduce the risk

To help prevent grain poisoning, a number of additives may be included in rations that are high in grain content. Some of these are included in the ration over the first 2–3 weeks of grain introduction and are then removed from the ration for the remainder of the grain feeding period.

Some examples of additives used are as follows:

- **Ionophores** such as monensin (sold as Rumensin®) – these modify the rumen to decrease the amount of lactic acid produced. Ionophores should be used as per the instructions on the manufacturer's label.
- **Virginiamycin** (sold as various Eskalin® products) is a **selective antibiotic** that reduces the risk of acidosis by reducing the numbers of acid-producing bacteria in the gut. Adequate mixing so that the Eskalin® is evenly distributed through the grain, and careful adherence to the manufacturer's recommended dose rates, are essential when using this product to achieve good protection against grain poisoning.
- The use of Eskalin® has been recently reviewed by the Australian Pesticides and Veterinary Medicines Authority (APVMA). All virginiamycin products are now S4 (i.e. prescription only), so can be obtained only through your veterinary surgeon. Additional restrictions on the use of virginiamycin are also to be implemented as labels are changed in compliance with the review. These are that Eskalin® may now only be used for a maximum of 28 days feeding for any animal or group of animals, with only one feeding regimen in any 12 month period.
- **Dosing with rumen fluid** from animals adapted to feedlot rations protects against grain poisoning by introducing rumen flora that utilise the acid produced. However, this is seldom a practical option.
- **Sodium bicarbonate** is often included in feedlot rations at 2% of the ration.
- **Sodium bentonite** can be included at 2% of the ration for the first 2 weeks of grain introduction, and then omitted.
- Although often used as a preventative, there is very little evidence that either bicarbonate or bentonite are effective in reducing the risk of acute acidosis (JB Rowe, personal communication).

Treatment

Initial treatment

Animals found gorging on grain may not show symptoms for 12–24 hours. Those animals that have received a toxic dose of grain will usually show signs of depression and will stop eating.

If unadapted animals have consumed unknown quantities of grain, the animals should be immediately removed from the grain and fed good quality hay. Some producers claim that allowing affected animals to drink increases the rate of development of acidosis. However, it is more likely that animals in the early stages of grain poisoning are stimulated to drink, and simply begin to show signs shortly after drinking.

If the likelihood of poisoning is considered high, emergency slaughter should be considered prior to symptoms appearing. This is likely to be the most humane option, and avoids the risk of financial loss, should treatment be unsuccessful. However, this decision must be made immediately, as meat quality will be adversely affected once signs of acidosis develop.

Where animals are already showing signs of grain poisoning, treatment will be dependent on the severity of signs and the individual animals at risk. Feeding hay may be sufficient treatment for mildly

affected animals. If symptoms worsen, individual treatment may be an option.

Individual treatment

For mildly affected animals

Mildly affected animals that are still eating hay will usually recover, with no treatment other than the removal of grain from the ration. Feedlot animals that are scouring can be temporarily changed to a ration 20%–25% lower in grain content for 2–3 days to see if their condition improves.

For animals showing signs of intermediate severity, or for valuable stock with symptoms not yet present

- Drench with at least 4 litres of normal rumen fluid, if available (e.g. if you have an abattoir nearby, or are set up to kill one of your unaffected animals for your own consumption).
- Encourage the animals to eat roughage or any palatable pasture. Hand feed if necessary.

Many vets (and textbooks) recommend the use of sodium bicarbonate as a drench, e.g. 130 g $NaHCO_3$ for cattle and 13 g for sheep, in a suitable volume of water. However, if the pH in the rumen is less than 5.5, the introduction of bicarbonate is likely to generate a rapid release of CO_2, and bloat can become a major problem (JB Rowe, personal communication). It is doubtful whether the relatively small amounts of bicarbonate normally introduced will have any significant effect on the amounts of acid generated by even 1 kg of grain.

For animals that are severely affected

Animals that are severely depressed, are unable to stand, and have subnormal temperatures, need urgent veterinary attention. For welfare reasons, consideration should be given to immediate destruction of the animal according to the guidelines set out in Primefact 310 *Humane destruction of stock.* Information on the humane destruction of cattle is also available in the *Australian Model Code of Practice for the Welfare of Animals: Cattle*, published by CSIRO Publications.

Very expensive animals, such as breeding stock, can be intensively treated in order to try to prevent their death. **These treatments can only be carried out by a veterinarian and should only be used under extreme circumstances where stock are considered very valuable.** Some treatments include:

- surgically opening the rumen and removing the contents to prevent further fermentation;
- replacing rumen contents with at least 4 litres of rumen fluid from a normal animal, if available;
- administering fluids intravenously to prevent fatal dehydration and help reverse the acidosis.

In short, these treatment methods are very time-consuming and labour-intensive, and hence very expensive. Good management, prevention and quick action are viable and more attractive alternative courses of action.

Further information

Further information can be obtained from your local District Veterinarian, Departmental Livestock Officer or private veterinary practitioner.

Acknowledgments

The assistance and advice given by James Rowe, Chief Executive Officer, Australian Sheep Industry CRC, in preparing this Primefact is gratefully acknowledged.

The assistance given by Lee Cook, Veterinary Officer Chemical Control, is acknowledged in updating the information relating to registered products/Eskalin®.

Ed Clayton, former Livestock Officer at Armidale, was a co-author of an earlier version of this Primefact.

ISSN 1832-6668

Replaces Agfact A0.9.53

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Job number 7119