Silage and Animal Health

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Animal problems associated with silage are not very common but when they do occur, they are not quickly forgotten! Symptoms of animal health problems are decreased intake which leads to decreased production, abortions, scouring and even death!

However, despite silage being the obvious and guilty party in many cases, it is also the scapegoat for many not so obvious causes, bit like snake bite as a cause for "dead animals with no obvious reason". That's the bad news! The good news is that most of these issues can be prevented by sticking to the well proven harvesting and storage guidelines for making silage.

- Avoid harvesting over mature crops
- Harvest quickly (24 – 36 hours ideally)
- Ensure that dirt, manure and dead animals are not incorporated
- Consider using a silage additive: -
  - to increase rate of fermentation (fermentation enhancers or fermentation inhibitors), especially when forage is slightly below desirable dry matter content
  - to delay aerobic deterioration (aerobic spoilage inhibitors) at feed out, especially in maize, whole crop cereal stacks and if using slow feed out rates in stacks
- Ensure high density in stacks or bales by good compaction
- Seal stacks or bales airtight with plastic or alternative as soon as possible after harvesting is completed
- Regularly check and repair any holes immediately
- Feed out at least 150 mm of silage face each day (300 mm every 2nd Day)
- Ensure baled silage is eaten by day 3 once opened

Rapid lactic acid production in anaerobic conditions is the desired type of fermentation but even here, storage and feed out management must prevent spoilage from entry of air (aerobic spoilage).

However, surveys have revealed a wide variation in the fermentation quality of silages, with many being unstable and/or poorly preserved. These are the major causes of "problem" silages which can lead to animal health issues.

During harvest, undesirable micro-organisms can enter the forage material via soil contamination (mud, dust) and livestock waste (dung, effluent and carcases). Alternatively, these organisms can increase in numbers by an environment suited to them in the silage storage.

What can we do to minimise the risk of individual problem micro-organisms?

Listeriosis: Listeriosis is a bacterial infection caused by *Listeria monocytogenes* and can cause abortions (usually in late pregnancy), neonatal septicaemia, brain damage ("circling disease") in sheep, or even death. Listeriosis is more common in animals

with weakened immune systems – particularly new-born and pregnant stock. Sheep are inherently more susceptible than cattle.

Listeria monocytogenes is found in soil, faeces and rotting vegetation and can reproduce at low temperatures, as well as in heating silage.

Although Listeria bacteria require aerobic (air) conditions to grow and multiply, they are able to survive under anaerobic (no air) conditions. Also, because they are intolerant of acidic conditions and, under anaerobic conditions, their activity is severely restricted below a pH of about 5.5.

Therefore, listeriosis is often associated with baled silage due to slow air entry via holes, if poorly or insufficiently wrapped and with plastic degradation over time. *Listeria* can also growth in stack silage for similar reasons.

If l*isteria* bacteria are present they are usually in the surface spoilage layer and removing this layer prior to feeding, greatly reduces the risk of listerosis. However, it is much better to have avoided listeriosis initially by effective sealing and maintenance of the seal.

Enterobacteria: Also known as coliform organisms, the most important micro-organism in this group is the *Escherichia coli* (*E. coli*) species and can cause diarrhoea and death. *E. coli* and other related enterobacteria (*Bacillus* and *Clostridia* species) become a greater risk when effluent is applied to paddocks closed for silage. Effluent sprayed onto paddocks closed for silage must be well washed in by rain before harvesting.

A slow fermentation favours the growth of enterobacteria and so can compete more strongly for the water-soluble carbohydrates (plant sugars and starches) with the more desirable lactic acid bacteria in the early phase of fermentation. The result is that less lactic acid is produced and the desired rapid decrease in pH i.e. increase in acidity, does not occur.

Another side activity of enterobacteria in silage is their ability to degrade nitrate (NO_3) to nitrite (NO_2) and this in turn is degraded to ammonia and nitrous oxide (N_2O). When air is present, the nitrous oxide (N_2O) can then be chemically degraded further in the silage to nitric oxide (NO) to form a mixture of gaseous yellow-brown nitrous oxides. These can be fatal to both stock and humans, but very rarely occurs in Australia due to lack of housing of either animals or the silage.

Clostridia: Clostridia bacteria can cause silages of reduced quality and low palatability as well as a potent clostridia species causing death.

1. *Clostridia affected silages* are less palatable due to protein breakdown, have a lower digestibility and results in reduced intakes and may cause acetonaemia in high yielding cows in early lactation.

2. Botulism is a disease caused by the bacteria *Clostridium botulinum*. Although its incidence is very low, eating contaminated silage (or hay) causes death very quickly.

When the carcases of dead animals (egs, rats, birds, snakes and other small animals) are ensiled, *C. botulinum* bacteria multiply and can produce a very potent toxin. Another often unseen source of contamination are vermin that burrow into and nest in silage stacks and bales, and then die often due to excess carbon dioxide in their burrows, especially if burrows are vertical with no outlet for gas escape. Whole crop cereal silage is a favourite. Botulism has also been reported from silage made from a paddock to which poultry manure was applied.

Spores from another Clostridial-type bacteria, *Clostridium tyrobutyricum*, which survives going through the animal, can affect cheese making by entering milk from ingested silage via faeces and faecal contamination from the udder.

Clostridia bacteria can grow in wet silages which have a pH above 4.6 such as can occur in stack silage where air has gained entry. The silage is foul smelling and usually of low palatability. Bales of silage are often shrunken, effluent in the bottom and sagged heavily as shown in figure 1.

Figure 1. Bale too wet. **Figure 2. Mould on baled silage**

Moulds: Moulds (Figure 2) and fungi on their own are not dangerous to livestock apart from ingestion of spores in over dry silages (and more so hays) which can cause respiratory problems. Obviously, silage quality and intakes will be reduced.

Only a small number of moulds actually cause problems but the difficulty is recognising them in the field, and analyses are very expensive due to the time involved in culturing the many and varied mould, yeasts, bacteria, etc. present in the material.

To complicate matters abortions, deaths, poor wellbeing, etc. may only occur when the animals are at a certain stage of pregnancy and/or the mould spores are at a certain phase of their life cycle. There will be occasions when the mould spores are at the "right or deadly" stage.

However, some moulds will produce mycotoxins which can cause severe animal health problems (See below).

Moulds require aerobic conditions for growth so poorly compacted, poorly sealed stacks and bales, holed plastic and slow feeding out rates will result in large quantities of air infiltration and leading to mould growth.

Mycotoxins: Mycotoxins are products of mould/fungal metabolism and can be found in silage, hay and any other feed that has aerobically deteriorated during storage. To produce toxins fungi, need a temperature above freezing, a moisture content above 20% (i.e. less than 80% DM), and air (oxygen).

For the scientists amongst you, *Fusarium, Aspergillus* and *Penicillium* are the most prolific producers of mycotoxins in silages. Mycotoxins of concern are deoxynivalenol (DON), aflatoxin, T-2 toxin, zearalone, moniliformin, ochhratoxin, roquefortin C and patulin. They are most likely to be found in silages that have undergone aerobic spoilage.

Mycotoxins affect animals through three mechanisms:

a) alteration of nutrient content, absorption, and metabolism
b) changes in endocrine and neuroendocrine functions
c) suppression of the immune system.

Depending on the type and amount of mycotoxin present, mycotoxicosis symptoms in animals are reduced feed intake, decreased animal performance, poorer fertility, increased incidence and severity of disease as a result of reduced immune function (due to liver or kidney damage) and abortions.

However mycotoxin presence may not always be the blame for poor animal performance. Even if they were, the multiplicity of potential toxins renders it sometimes impossible to diagnose accurately the cause of the disease. Because mycotoxins can be a serious hazard to both animals and humans, their presence should be minimised by proper harvesting and storage techniques.

Can I feed mouldy silage?

The risk to livestock from feeding mouldy silage is thought to be minimal and not much greater than the risks associated with feeding mouldy hay. Reports of animal deaths from either source are not common but do occasionally occur. There is no evidence to suggest that colour of the mould is any indication of toxicity.

To be on the safe side, if mould is observed, and potential animal health risk (from possible mycotoxins) is a concern, remove any obvious mouldy silage prior to feeding, if possible. If is has to be fed, feed sufficient to allow livestock to avoid eating the mould and preferably, avoid feeding mouldy silage to very hungry livestock. Definitely DO NOT feed mouldy silage to pregnant animals and NEVER to sheep or horses.

However, silage which is extremely wet and which has aerobically deteriorated over time may be a time bomb in some cases, particularly summer forages such as sorghum. No moulds may be seen in these cases but occasionally can be fatally potent.