Baled Silage: Success or failure after six months storage?

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Baled silage is expensive enough without pulling the wrap off to see mouldy and/or very unpleasant smelling silage inside when feeding it out 6 – 12 months after harvest. However, just like a carcass competition, farmers and contractors can learn a lot when the plastic "skin" comes off.

Whenever the bale ensiling process has been compromised (egs. punctured plastic seal, baled too wet or too dry), dry matter (DM) and nutrient losses will occur, along with animal health issues occasionally. These losses can "appear" to be small but are usually far higher than thought. Large losses that appear large, are also much larger than imagined. The extra effort to prevent, avoid or repair problems is well worth the effort timewise and financially.

Understanding a simple "act of nature" equation can be very useful in determining problems in baled (and forage harvested) silage.

Silage + Oxygen produces Carbon Dioxide + Water + Heat

Freshly mown grass, sealed silage with damaged plastic film and silage at opening/feeding out, also have the same result when exposed to air (oxygen)! When determining a problem, if mould is present, air is usually or has been present. If the bales themselves or the plastic film is obviously wetter than expected, or wetter than when wrapped, then the silage is probably breaking down producing this excess water, which you can see. Carbon dioxide will have been produced but not seen and heat, sometimes but often not felt because the heat has escaped before being detected.

Failed baled silage can be categorised into:-

- Incorrect dry matter content at baling
- Wrapping/Sealing problems
- Plastic seal is damaged
- Plastic film quality
- Pests

Incorrect DM content at baling

Bale DM content too high = Mould growth. Material baled too dry (over about 55 % DM) in round bales cannot be compacted enough to expel excess air. This entrapped air will allow plant respiration and aerobic (air loving) microbial activity to continue leading to DM and quality losses. A certain amount of mould (and yeast) growth may also occur depending on the quantity of air entrapped (Figure 1). The problem is dramatically compounded in over-dry bales if the plastic wrap is holed because the air can enter more quickly, and further, into the bale

Bale DM too low = Sunken, misshaped bales and usually has undergone a very poor fermentation (Figure 2). Most bales baled under about 38% DM may undergo a

clostridial or enterobacterial fermentation. This is due to the high moisture content and slower rate of fermentation because the material is not chopped as in a forage harvested crop. The wetter the silage becomes towards the base of the bale, the wetter it was at baling, or the more it has broken down due to incoming air.
Solution: Round bale DM should be 40 – 50% DM. Large square bales 40 – 60% DM. Use a chopper baler for over dry bales, with ALL knives in place. Use a fermentation enhancing silage additive for over-wet bales.

Figure 1. Mould due to presence of air

Figure 2. Baled too wet without silage additive

Wrapping/Sealing problems
Unevenly shaped bales. Despite bales being correctly wrapped with four layers at 50 per cent overlap and 55 percent stretch in Australia or six layers at 70 per cent stretch in New Zealand, air will still very slowly enter the bale over time. These losses are minimal over about twelve months, sometimes longer. However odd shaped bales will not have the minimum of four layers of plastic over the entire surface of the bale. Underlapping of the film will occur (Figure 3) which will allow air to enter the bale at a much higher rate where the film is three layers instead of four.

For the lighter coloured films, cut out a square section (~ 30 cm square) of the suspect area. Hold it up to the light and you often expose/verify underlapping. Then carefully pry apart and count the number of layers in the lighter zone.
Solution: Ensure bales are square or slightly convex in shape. Apply extra wrap over underlapped sections.

Figure 3. Bale wrap underlapped

Pre-stretcher issues. The film passes through a pre-stretcher to ensure the film forms an airtight seal on the bale. Poorly serviced pre-stretchers may over/under stretch the film. If the film is not stretched enough, or is over stretched, or film runs through the pre-stretcher the wrong way, then the seal will be very inadequate.

With the advent of pre-stretched films onto the market, separate gear sets were required for these films. With a machine being on-sold, or the correct gears are lost or forgotten to be exchanged, etc. sealing problems are the result. Dust and rain will settle between the film layers and will prevent a good seal forming. Unused plastic rolls stored in the sun's heat during the day's harvesting will not "neck down" or stretch as well as it was designed to do.
Solution: Service the pre-stretcher regularly. Use the correct gearing for the specific plastic wrap used. Store unused rolls away from direct heat and avoid dust and moisture getting between the film layers at wrapping.

Plastic wrap is damaged
Holes in plastic film. The drier the forage, the larger the hole, the higher the ambient temperature and the longer a hole is left unpatched, the greater are the losses. Make no mistake, even a very small hole will quickly lead to large DM and quality losses if left unsealed for too long.

Sometimes pin-sized holes will occur in plastic rolls which have been removed from their protective box/wrap and are moving freely in the back of a ute, more so if there is bits of sand or gravel on the ute floor. Where lucerne or cereal stalks protrude from the bale holes and which seemingly act as a plug against air entry, will soon rot off and allow air in!

Unsuccessful patching. Often, patching is unsuccessful, even when carried out immediately. Gray duct tape will not last very long. Some tapes break down very quickly in sunlight. Repair tape applied to dirty, wet or hot plastic will also fail. Applying a dark coloured tape to a light coloured plastic will often fail due to differential in plastic shrinkage and expansion in hot/cold conditions (Figure 4). Tape not applied correctly can still allow air entry (Figure 4).
Solution: Regularly inspect bales and patch holes as quickly as possible using repair tape specifically designed for plastic wrap. Before applying the patch, clean and dry the holed area, cut the tape to length before applying and apply a similar coloured tape to that of the bale wrap. Avoid doing this in hot weather.

Figure 4. Wrong colour and poor application of black tape on light green film.

Transportation of bales. Spiking wrapped bales for transportation leaves large holes in the plastic film, as well as in the centre of the bale itself. If the bale is moved roughly, the whole bale will lose shape, leaving a larger hole around the spiked area and will also break the plastic film "tack" which aids in the sealing process. Research has shown that silage grabs or grips are much gentler on the wrap, as long as they are used carefully.

Many bale wraps are also "bruised" or "grazed" when transporting, loading/unloading or when standing bales on their ends, by all types of silage transportation equipment. Even though the film is not broken, there may NOW only be 3.0 to 3.5 layers covering that area, sometimes less!
Solution: Ideally wrap at the storage site. IF paddock wrapped, move bales with gently with equipment which does not puncture the film.

Plastic film quality
Quality of film varies between companies, between manufacturing runs (sometimes) and between countries. Most plastic film is manufactured to about 25 micron although some are now manufactured bit thicker or thinner. These films are thin compared to sheet plastic (25 cp 100 – 200 micron) so those produced with less than desirable quality control can vary substantially in thickness.

Ultra-violet (UV) light inhibitors prolong the period before solar radiation starts to break down the plastic. Film which starts to break down can be recognised by it starting to split, or the edges lifting and easily “rips” when pulled instead of stretching (Figure 5).

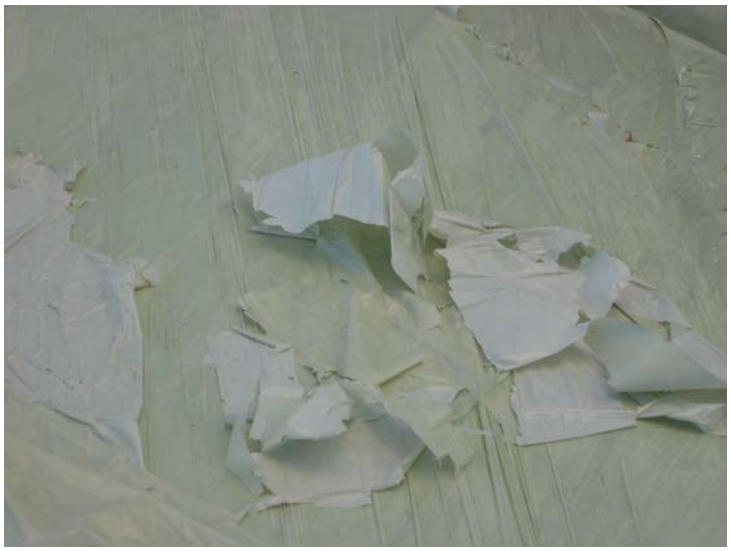

Figure 5. Film breakdown due to solar radiation

Some European countries use negligible or low rates of UV inhibitor in their film due to much less sunlight intensity and so little problem with breakdown whereas Australian film requires the highest level for our hot climate. After the UK and European harvest is completed, the excess film is often exported to Australia for our harvest. Some of these films are of the highest quality, some are not!

Also the quality of resin used to make the film and the level and quality of the UV inhibitors to protect the film from solar radiation breakdown varies considerably worldwide. World pricing of fuel impacts on resin price so savings (short cuts by using poorer quality resin) are sometimes taken. The adage that you generally “get what you paid for” is foremost in silage film market!
Solution: Use films from reputable manufacturers and those who are prepared to at least discuss any problems which may arise, many of which are often NOT caused by the film!

Pests
There are many causes of holes in baled silage wrap. Birds, vermin, wildlife, cattle, domestic pets, children, tree branches, etc. can all cause holes in films. The grain in whole crop cereal silage baled at the soft dough stage is a beacon to vermin!
Solution: Try to control pests. Eg. Place bales on sand or bare soil. Leave gaps between bale rows for easier inspection and repair. Use vermin bait before vermin start to appear. Place hay netwrap along the tops of bales, preferably on tops of tires as birds hate to have their claws entangled. String humming wire over the tops of bales through the handles of plastic drums half filled with water wrap. Ensure fences are always stock proof.