Department of Environment and Primary Industries

Reducing silage waste in wrapped bales

Frank Mickan
Pasture and Fodder Conservation Specialist
DEPI, Victoria

There is much needless waste of silage in wrapped bales all over Australia. Needless because often only a small attention to detail or slight changes to management can stop or at least reduce substantial losses of silage dry matter (DM) and quality on many farms. There are no short cuts when wrapping round or square baled silage.

Say a 1.22 m (4′) round bale of silage with a diameter of 1.37 m (4′6′′) weighed 300 kilogram of dry matter (kg DM), approximately 600 to 650 kg fresh weight. If a hole is left unattended for only a few weeks, this could result in about 10 per cent wastage of that bale, potentially representing at least $11 loss in milk production not achieved.

This figure is derived from 10% of 300 = 30 kg DM waste. With a silage quality of 10 megajoules of metabolisable energy per kilogram of dry matter (MJ ME/kg DM), 30 kg DM x 10 MJ ME = 300 MJ ME lost and using 8 MJ ME to produce one litre of milk (at 30¢/L), the loss is about $11. Many bales have much greater losses than this. Why wouldn't you try to minimise losses?

The target for baled silage is high quality forage ensiled into bales at the correct DM content (40 – 50% for rounds, 40 – 60% for squares), densely compacted and wrapped with the correct number of layers (four layers at 55% stretch) over the entire bale. If achieved, the silage will have a pleasant smell with negligible mould anywhere on the bale when opened up to twelve months later.

Any mould noticed on or in the bale indicates that air has entered the bale somewhere, somehow, and the amount of mould and its location can often be an indicator to the cause (and its solution). Similarly, the amount of moisture and its location in the bale can help pinpoint the cause.

Be aware that baled silage has six to eight times the surface area in contact with the plastic film compared to conventional stack silage and about half of the silage volume is within 15 cm of the plastic film. Therefore, it is important that the integrity of the film is not compromised in any way until fed out.

This article discusses some of the characteristics of wrapping bales and how these and other factors cause failures in baled silage.

Pre-stretch rate: Many people think that any plastic is airproof and will prevent all air from passing through the film and entering the bale. Wrong! Most stretch wrap films have a thickness of 25 micron (µm) before application to a bale. Most wrapping machines sold in Australia are designed to pre-stretch the stretch wrap plastic 55 % as it is applied to the bale. If four layers are applied, the final thickness will be about 18–20 µm per layer, which is 74–80 µm in total. Square bales should have six layers as the edges can cause some slight over stretching and also more prone to puncturing due to plant stalks. Continuous in-line wrapped bales stretched to 55% should have six layers applied and more at the joins if bale diameter differs as over-stretching here usually results in the plastic splitting, allowing air to enter.

If stretched 70 %, as is common in New Zealand, thickness is further reduced, hence their recommendation to apply six layers versus our four! Compare the 74–80 µm cover to the thickness of 120–200 µm for plastic sheets sealing bulk cut silage. Be aware that any film stretched to 70% will require a change of gears on the pre-stretcher.

A new stretch wrap film has recently been introduced into Australia which is co-extruded with five layers instead of three and, as a result, is said to be much stronger and more evenly stretched. The company stipulates 70% pre-stretch and to apply four layers to round bound bales, but do suggest six for increased security. They also recommend applying six layers to continuous in-line wrapped bales and suggest eight at the bale joins.

Farmers and contractors may also remember another Australian company, with the aim to reduce plastic costs, introducing a 35% pre-stretched film which also required a change of gearing on wrappers. There is a potential problem looming of gearing and stretch wrap mismatches once machines start to change hands or different films are used, if the gearing information is not also passed on.

To check that the pre-stretcher is working and/or the correct cogs are in place, mark a 10 cm line or trace around a match box on the roll of film (Figure 1). Once pre-stretched and applied to the bale, re-measure the mark. At 55% stretch the line should now measure just over 15 cm or the match box increased by half its original size.

Wrapping in high ambient temperatures (over about 25^{O} Celsius) may affect the properties of some plastics, particularly the stretch rate.

Bale coverage: Every round or rectangular bale that is being individually wrapped MUST have at least four layers of plastic (at 55% stretch) over the ENTIRE bale. This is difficult to achieve with slightly odd shaped bales resulting in underlapping (Figure 2) and only three layers will be applied at that section causing plastic coverage to be reduced by 25% on a seal where 100 % coverage is a must. Overlap for each layer should be at least 50%, no less.

Baled crops with mature or stemmy material should have six layers applied to reduce puncturing of the film and extra care taken when placing bales onto lucerne or cereal stubbles.

Centre the bale: Larger diameter bales are becoming more common and if the pre-stretcher is aligned with the bale centre, wrapping will be uneven on the bale.

Number of layers applied: Bales which have had four layers of stretch wrap film applied at 55 % stretch with a 50% overlap and guaranteed to last 12 months the film starts to degrade from solar radiation, sometimes lasts several months longer. Practical experience in the field has shown that applying six layers at the above stretch will generally ensure bales will last a further 12 months.

Overseas research comparing two, four, six and eight layers, at 70% stretch, has shown that two layers will result in huge losses of DM and nutritive value due to mould and yeast growth and aerobic deterioration due to air entry. Applying four layers resulted in only slightly extra surface mould (0.5 – 1.7 % of bale surface) growth compared to six layers (0.1 – 0.7%). However, six to eight layers may be necessary if wrapping drier or more mature pastures, especially for sheep and horses which have low tolerance to mouldy feeds. Six layers are recommended if bales are to be transported after wrapping.

Colour of plastic: Based on overseas research, the lighter-coloured films would be more suited to the hotter areas of Australia compared to black due to less surface heating. Black is more absorbent of solar radiation. However, in the cooler temperate areas such as southern Victoria and Tasmania, black wrap is equally effective and may be less prone to UV break down.

Plastics ain't plastics!: Most films are now of good quality with adequate levels of resistance to UV light degradation. Films can vary in permeability to air, consistency in its stretching capacity, degree and longevity of adhesiveness or "tackiness". They can also contain irregularities from the production line, have unevenness of colour integration and, most importantly, the quality and amount of ultra-violet (UV) light inhibitor impregnated into the plastic film can vary substantially between products.

Holes: Probably the largest cause for wasted baled silage. An Irish experiment measured 8% loss of edible silage from one 3 mm hole, 15% loss from 10 holes of 3 mm diameter but about 32% lost from one 24 mm sized hole if left unpatched for 5 months compared to under 1% in undamaged bales.

The above Irish bales were only about 30% DM compared to Australian bales commonly having a DM range of 40 to 50% so losses can be expected to be higher here. Bottom line, the drier the forage, more stemmy the material, warmer the weather, larger the hole and the longer before being repaired, the greater are the DM and quality losses and greater the mould growth and aerobic deterioration.

Many batches of bales are protected by single-wired electric fences which too commonly don't do the job. Damage caused by animals breaking in and ripping large holes in the film is almost impossible to repair unless rewrapped, which is rarely done. Worth the extra cost of more permanent fencing?

Birds, vermin, cats, possums etc. are other causes of holes and most of these problems can be overcome with persistence (Figure 3). Regularly checking for damage and patching with similar coloured specific silage repair tape to clean, dry and cool/warm plastic will reduce losses substantially.

With a bit more effort or extra time large losses of baled silage can be reduced substantially, resulting in more feed for animal production.

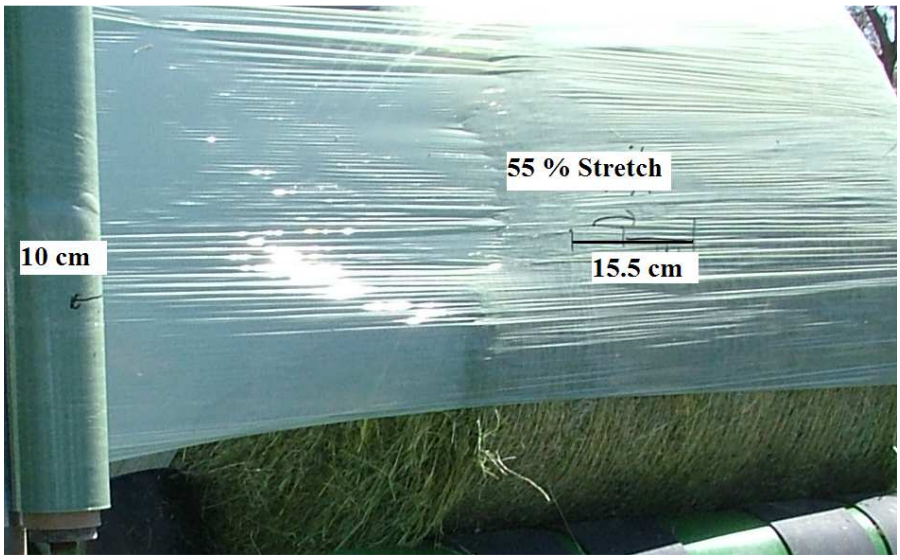

Figure 1. Checking 55% stretch of stretch wrap film

Figure 2. Underlapped film on round bale

Figure 3. Using bale netwrap to protect against birds (Better with tyres under netwrap)