

## Wrapping silage bales is becoming very confusing

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The days when wrapping silage bales was simple and straightforward are gone! Now there's a variety of older stretchwrap films and those with newer film resin and manufacturing technology in the market place amidst facts, misinformation and marketing spin on the market.

So it's no wonder farmers and contractors are confused.

We have stretchfilms with different characteristics, different thicknesses ranging from 12 micron through to 30 micron, recommendations by different manufacturers to apply four, six or even eight layers of film and different amounts of pre-stretch before going on to the bale.

To add to this confusion, bale size and weight have increased substantially with improvements in balers, combined baler/wrappers and various types of wrappers. This has created some traps for the unwary.

Air is still the enemy of silage and in changing the film type, pre-stretch amount and number of layers will all have an effect of the films permeability to prevent oxygen transfer. Remember, there are no short cuts when wrapping round or square baled silage.

Round bale weights now vary from about 500 to nearly 1000 kilogram wet weight depending on bale size, dry matter (DM) content, baler used and operator input. Most round bales of silage are still about 1.22 m (4') in length but diameter can vary from 1.22 m (4') to 1.37 m (4'6") and approaching 1.52 m (5').

**Now, to the films.** The ultimate stretch film must be strong, resistant to tearing and puncturing, have consistent elasticity during application, anti-UV degradation and sufficient tack (glue) to cling in all situations and guarantee against UV degradation for least 12 months.

Bales should have no mould at opening and quality of the forage going into the bale should be very similar to that being fed, notwithstanding there will be some losses due to fermentation.

Manufacturer's recommendations for the pre-stretch amount and the number of layers should be followed for manufacturers guarantees to stand.

**Three and five layer film technology:** Gone are the days of single layer or cast film, replaced initially by three layer stretchfilms which allowed ultra-violet (UV) light inhibitors, UV stabilisation features and tack to be spread more evenly to produce a film with many benefits over the original. Stretchfilm manufacturing technology has advanced further still to allow the production of stretchfilms with five distinct layers within the film's structure hence the name 'five layer' film.

One manufacturer with such new production facilities says that with five layer technology UV stabilizers are placed on the outer surface of the film to face the weather; the tack is placed on the inside face for an effective seal and the bulk of the polymers providing the strength, tear and puncture resistance are placed in the inner film layers. This it says, makes five layer films superior to three layer stretch films.

The same manufacturer says that the newer technology allows it to produce a stretchfilm of consistent thickness and strength. As a result of the enhanced film structure, this

manufacturer confirms that its 5 Layer stretchwrap films can be applied at 70 per cent (%) stretch.

**Pre-oriented films:** Another recent development is the appearance of ‘pre-oriented’ films in the market. One such pre-oriented film recently launched is described by the manufacturer as a five layer stretchfilm that has been compacted during manufacture to reduce its thickness which, in turn, serves to enhance the film’s oxygen barrier properties. This new generation stretchfilm has a greater reel length and will wrap about 26 per cent more bales per the same sized reel. Being produced using the newer five layer manufacturing technology the manufacturer confirms that it can also be applied at 70% stretch.

The manufacturer recommends that the new generation of five layer or pre-oriented stretchfilms are applied at 70% stretch for all individual round bales. It says that the superior nature of these films meant that extra layers did not need to be applied despite the films being stretched further than lower stretch % films.

**Pre-stretch setting:** Historically, stretchwrap films used to be pre-stretched about 55% as it was being applied to the bale. Now some companies of newer 5 layer films are recommending a 70% stretch for their products which requires another set of gears for the pre-stretcher. However, these latter films will still work at 55% pre-stretch.

Most wrappers mark somewhere on their machine the percentage of pre-stretch although no help if gears are changed at some time. There are also some films where some pre-stretching is carried out in the factory requiring less stretch at the bale but does it does require a new set of pre-stretcher cogs. Not in Australia yet but no doubt will be in the near future is an equipment supplier recommending a 90% pre-stretch with still 70% being an option.

**Number of layers applied:** Another major confusion surrounding the use of stretchwrap film is the number of layers to be applied to individually wrapped round and large rectangular (“square”) bales and continuous In-line wrapped rounds and squares.

Different messages are given by the many equipment suppliers, service providers, consultants and government advisors such as myself involved in providing advice to the silage production industry. Table 1 provides recommendations as supported by most manufacturers and advisors.

There is a general consensus amongst advisors that a minimum of four layers is required for round bales wrapped with a three or five layer film and also a minimum four layers when wrapping round bales with a pre-oriented film. Additionally, if wrapping square/rectangular bales or if wrapping continuous inline a minimum of 6 layers is recommended for all film types.

**Table 1. Number of layers to be applied to various silage bale forms**

Film type and guage (micron, µm)	Pre-Stretch (%)	Individually wrapped bales		Continuous In-line wrapped bales	
		ROUND bales <sup>1</sup>	RECTANGULAR bales <sup>2</sup>	ROUND bales <sup>3</sup>	RECTANGULAR bales <sup>3</sup>
Three Layer: 25µm x 750mm x 1500m	55%	Minimum of 4	6	6	6
Five Layer: 25µm x 750mm x 1500m	55% or 70%	Minimum of 4	6	6	6
Pre-oriented: 21µm x 750mm x 1900m	55% or 70%	Minimum of 4	6	6	6
Pre-stretched 3 layer: 14µm x 730m x 2600m	35%	Minimum of 4	6	6	6
Pre-stretched 3 layer: 16µm x 730m x 2300m	55%	Minimum of 4	6	6	6

<sup>1</sup>Apply 2 extra wraps on stalky crops + potentially extra 12 mths storage. 6 layers also recommended for bales to be handled and/or transported

<sup>2</sup>Apply 2 extra wraps on stalky crops + potentially extra 12 mths storage. 8 layers is also recommended for bales to be handled and/or transported

<sup>3</sup>Apply extra wraps at the joins.

**Colour of film:** A perennial argument by the sellers of film. There is little doubt that the lighter colours are advantageous in areas where temperatures are high for much of the year but black film is still OK for the cooler climates. However, it is not recommended darker coloured bales be double stacked. During the hotter months the sun's heat can be reflected off one bale onto the next causing some degree of heat degradation of the film on the second bale (Figure 1).

**Film on Film:** Becoming available is the possibility of some balers and combination baler/wrappers that can apply a film instead of netwrap around the perimeter of the bale (Figure 2). The bale is then wrapped as per normal. Advocates of this system say that the use of two films (one to bind the crop into a bale and a stretchfilm to wrap it) delivers superior quality silage due to greater bale density and an enhanced oxygen barrier around the barrel of the bale.

It is claimed that whereas netwrap will elongate post-baling allowing air re-entry back into the bale, the configuration of the polythene film maintains the pressure and resultant compaction created within the baling chamber, and produces a much denser bale. This, together with the additional film layers applied around the bale perimeter - traditionally the least protected bale surface - significantly reduces oxygen ingress by about about 100L and reduces mould and yeast growth substantially. Research also found that the bales weigh about an extra twenty kilograms of silage per bale.

The Film on Film system can make the feed-out process easier due to the netwrap replacement film peeling easily and more cleanly from the bale as no fodder can become enmeshed in it as with netwrap. As both films are manufactured from the same material (polythene), once removed from the bale, they can be folded together and placed in the same bin for recycling

**3D Wrapping:** A different approach by at least one manufacturer is that their individual wrapper or combined baler/wrapper begin to wrap with the two pre-stretchers in vertical position, then switch to the horizontal position wrapping the edge of the bale, and the central part of the side before reverting again to the vertical position to finish off the bale with two layers. The result is much less wraps on the ends and about seven wraps on the bale perimeter (Figure 3).

**Oxygen Barrier (OB) Stretchwrap film:** Over recent years much research and ground truthing has been occurring to develop a stretchwrap film with the same oxygen barrier (OB) technology as is now available for stack silage. The OB film is almost 100 times more impermeable to oxygen than leading conventional stretchwrap films. When passing by bales with OB film, no odour is present as in most other films, indicating passage of gases from those bales and air slowly getting in.

The film is very expensive and has similar characteristics to traditional stretchwrap films of being 25 micron thick, UV-treated and guaranteed for twelve months, needing at least four layers, stretched seventy per cent etc. Research has shown that the use of this film will result in a reduction in DM losses by about 40% and slightly better quality bales.

#### **Some issues of which to be aware:**

- Mixing films requiring different pre-stretch treatment without changing to the correct cogs. An example of this occurred when a contractor, on a weekend, ran out of film on a job that was being pre-stretched 70%. Being a weekend he raced to town and could only get a film which required a 55% stretch. Not having the requisite gear the job went on.

- Most new wrappers now come with gears to allow 55% or 70% stretch but anyone buying a second hand wrapper must investigate which cogs are on or available with the machine. The pre-stretch percentage can be measured by counting the number of teeth on the gears or in field by marking a known length on the roll before application, then measuring it after application to the bale (Figure 4). A 10 cm mark on the film on the pre-stretcher should measure 15.5 cm at 55% stretch once applied to the bale.
- Stretchwrap film by its nature will allow some air (oxygen) into the bale after wrapping albeit at very slow rates. Air ingress occurs more rapidly as the film ages and more so if the film is underlapped (Figure 5) and substantially if holed or punctured. The newly developed OB film greatly reduces this rate of air ingress..

**The final say:** I still maintain that four layers of a high quality three or five layered stretchwrap film applied to individual bales with the correct stretch and at least a 50 per cent overlap will store round bales satisfactorily for 12 months. I am all for applying an extra two layers as added insurance, possibly slight gains in quality due to less ingress of oxygen and slight saving in weight loss due to a more efficient fermentation and less oxygen entering the bale at all stages. The extra layers also provide more strength especially if transporting them, increased puncture resistance and probably allows an extra 12 months of storage.



**Figure 1. Film on darker bales damaged by reflected sun heat on both bales**

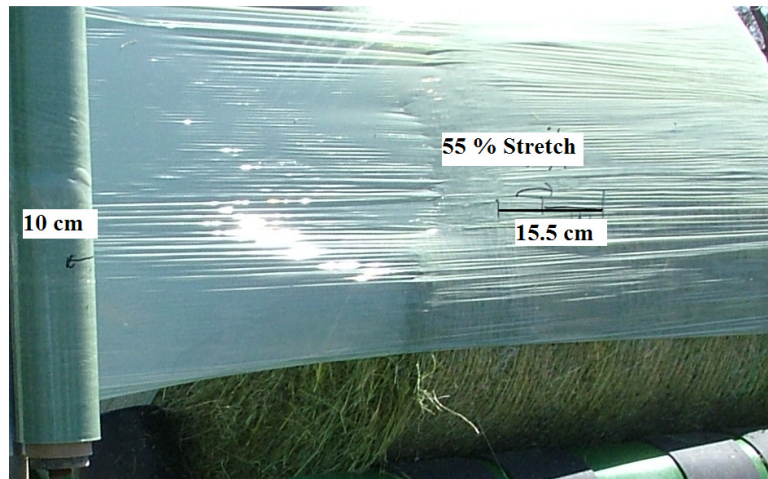


**Figure 2. Netwrap replaced by stretch wrap film**





**Figure 3. 3D wrapping over netwrap**



**Figure 4. Checking for pre-stretch**



**Figure 5. Bale with underlapped wrapping**

