Do hay preservatives have a place!

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Every year a number of hay stacks self-ignite or spontaneously combust, ie. catch fire! Many haystack fires are caused by lightning strikes, sparks from moving or stationary machinery, sparks from grinders and nearby grass fires, children sneaking a puff, insurance claims, inexperienced operators baling hay too early, etc.

However, many fires are due to spontaneous combustion caused by excess moisture at baling. This excess moisture could arise too much "free" or moisture on the exterior of the plant such as dew, ground surface moisture or light drizzle or fog residual on or in the windrows at baling. Crops with inadequate curing will result in too much internal moisture in the plants themselves, often referred to as "sap" moisture.

Over the last summer, Australian farmers, hay growers and fodder contractors experienced seemingly many more haystack fires than expected compared to normal seasons. This even occurred from contractors armed with many years experience and moisture meters!

It is believed that many of these "unexpected" fires may have been due to such factors as canola crops with "difficult to dry" thick stems, cereal crops at the boot stage with the developing seed heads in the top end of the stems, ie. boot stage and "wetter than normal" nodes, baling before the crop was cured enough, baling cereals with high sugar contents, etc. Also this previous summer, many fires started due to unseasonably heavy rainfall events which soaked deeply into uncovered stacks. Anecdotal comments have stated that in many cases the hay making was "spot on" in many instances but spontaneous combustion still occurred!

Could hay preservatives have prevented some of these haystack fires?

Short answer, possibly in many cases, but not all preservatives may have been totally effective. There were several stack fires where preservatives had been applied but was this a failing of the preservative or was the application rate too low or inadequately mixed throughout the material at baling? Spraying the preservative on top of the windrow just before baling, especially thick windrows, won't ensure adequate coverage.

Hay preservatives are designed to reduce microbial activity and mould growth in high moisture hays. The use of these products allows baling at slightly higher moisture contents resulting in shorter curing time, reduced leaf shatter and leaf loss (resulting in hay of higher nutritive value), helps retain greener colour and maintains good palatability, ie. tastes great. Slightly higher moisture contents means up to about 25% moisture in small square bales, although some organic acid products can be used up to about 30% moisture content but is not advisable (Figure 1).

There are now several hay preservatives on the Australian market. Most are based on the buffered salts of organic acids of propionic acid and mixtures containing propionic acid and ammonium isobutyrates, acetic acid and formaldehyde. The buffered

products are designed to overcome corrosion, pungent smell and volatility of the organic acids used previously. The down side, of course, is their higher cost compared to the straight acid products.

Other preservatives also available but use different modes of action such as bacterial inoculants suited to hay and a product containing enzymes + sulphur compounds are to achieve the same end. The inoculant types (eg. specific *Lactobacillus buchneri 40788* species) promote faster curing, stop plant respiration and prevent growth of mould, so reducing heating and losses. They claim to be suitable for hay baled up to about 25% moisture. They are safe for animals, non-corrosive and easily handled.

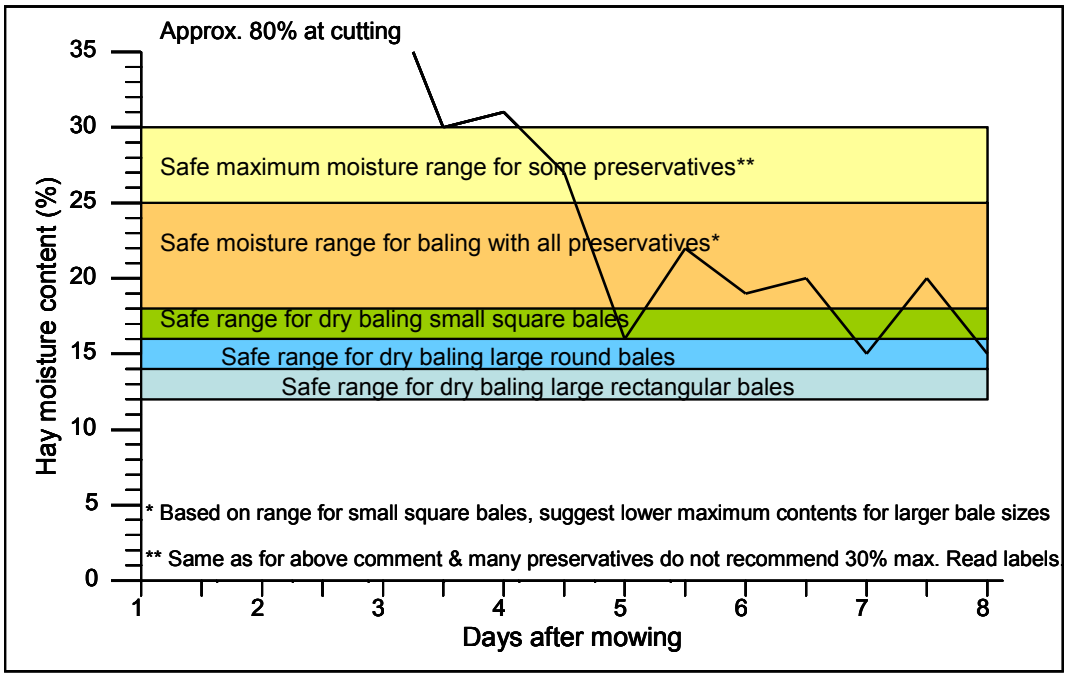

Figure 1. Moisture content at intervals after mowing and recommended safe moisture ranges for each bale form with and without preservatives

Application rates are based on the fresh weight of material and I suspect, in many cases, the rate applied by operators may have been based on past experience, or at the least, not allowing for enough of the extra moisture at baling. Not a lot of extra moisture is required to add substantial weight to the hay in the windrow, requiring substantial increases in preservative rates.

These are applied via an applicator, the rate being dependent on the active ingredient and moisture content of the hay. Most of these products are designed to be effective in hay moisture contents up to 25% but I would suggest this applies to small squares and so moisture limits should be dropped accordingly for rounds and large rectangular bales.

Table 1 shows an example of recommended preservative application rates for small square and large round bales of hay baled at different moisture contents. Note the quadrupling of application rate at the higher moisture contents. This necessitates spray nozzles which can apply a fine spray at medium pressures over the entire width of the pickup over a wide range of application rates.

Table 1. Preservative rates required over a range of moisture contents

Bale form	Moisture content range (%)	Preservative rate (kg/tonne)*
Large rectangular	16 - 22	2.81
	23 - 25	4.68
	26 - 39	Do not bale
Small squares, large rounds	16 - 22	1.87
	23 - 25	3.74
	26 - 39	7.48

* Converted from US pound per ton

Windrowed crops which have not completely cured will have wide variation in moisture contents along its length and throughout the profile of the windrow itself. Figure 2 shows the variation in moisture content of 75 metres of windrow tested for moisture every 3 metres of second cut lucerne, Artesia, New Mexico.

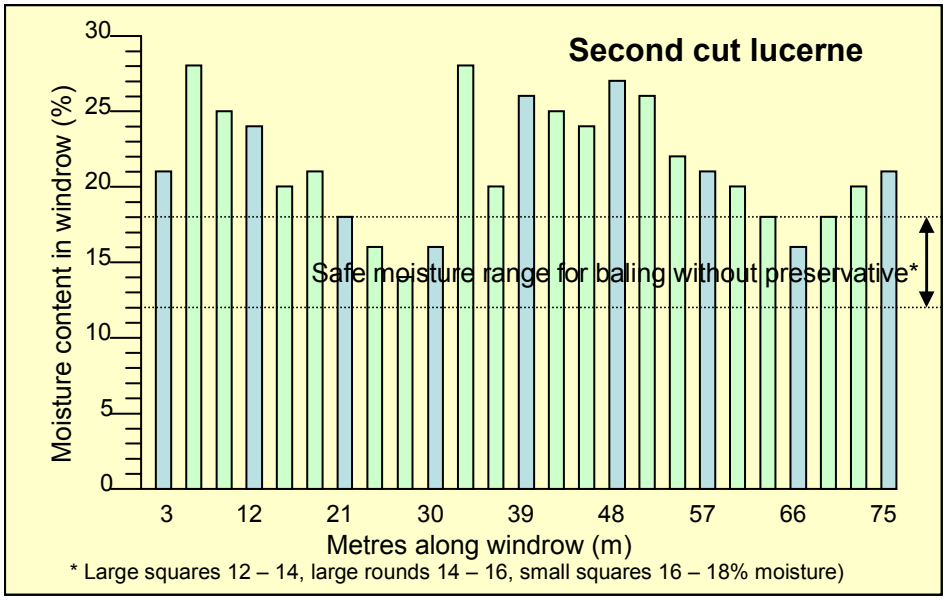

Figure 2. Variation in moisture content (%) along 75 metres of windrow

Read labels carefully. Are the recommendations based on dry matter content versus wet weight? Is the application rate based on product or active ingredient? Some products recommend higher rates for large rectangular bales than for large rounds and higher rates for stem or sap moisture than dew moisture only.

To decide on which application rate to apply, many samples from windrows across the paddock should be tested. An alternative is to test several freshly baled bales as long as they are representative of the material in the entire paddock. Application rates should be based on the higher moisture readings as this is the “danger” material, not the average of all readings.

Table 2. Recommended Moisture Contents (%) for Safe Storage of Hay

Type of Bale	Recommended moisture content ranges for baling hay (%)
Small square bales	16 – 18
Large round bales	14 - 16
Large square bales	12 - 14
Export hay	<12

Hay baled at slightly above the maximum moisture contents (2 – 3%) recommended in **Table 2 and** Figure 1 in each range will lose DM and nutritive value due to plant respiration and possibly mould growth resulting in heating of the bale/stack. Moisture contents well above the maximum moisture contents (4+ %) will have higher losses, more mould and heating, possibly resulting in spontaneous combustion eventually.

Don't forget, the preservative must cover all the cured forage and the application rates adjusted for moisture content. Don't be complacent once baling is finished and the hay is stacked. Keep an eye on the stack temperature for some time afterwards, just in case!