

## Value of Improved Hay Storage

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### Hay Losses During Storage

Losses during hay storage can exceed 40% under the most severe conditions and commonly average 25% for round bales stored outside on the ground during one season. Round bale storage losses are greater than is commonly understood, due partly to the cylindrical shape of the package. For example, even a 2" layer weathered on the exterior surface of a round bale has significant effects on storage losses (**Table 1**). Weathering is the term used to refer to the wet, discolored, frequently moldy layer on the exterior and bottom surfaces of round bales stored outside exposed to the weather. This weathered is greatly reduced in quality is often refused by livestock due to its very low palatability when whole bales are fed.

**Table 1** shows the percentage of bale volume contained in a given weathered layer. In making these calculations, losses on the ends of bales were disregarded because very little loss typically occurs there. The values presented are average weathering depths over the exterior circumference of the bale. Generally the greatest proportion of the total loss on bales stored outside on the ground occurs on the bottom, due to wicking of moisture from the soil. An inexpensive solution that may reduce losses from approximately 25% of the dry matter yield down to 16-18% is to break soil/bale contact by elevating bales on crushed rock, poles, pallets or some other means of providing air space between the bottom of each bale and the soil surface. Elevation is not necessary for bales covered in solid plastic since the plastic layer provides a barrier against moisture movement from the soil. Our research suggests that elevation would be beneficial for netwrapped bales.

Storage losses affect the cost of hay even if it is produced on the farm. Assuming that weathered hay is lost because it is not consumed by livestock, the cost per ton of hay actually consumed increases proportionally with the increase in weathering. Production costs for good quality legume hay are \$50 per ton or more depending on yields, production inputs and other factors. When the quantity of hay available is reduced by storage losses, these production costs must then be apportioned over a smaller amount of hay, thus increasing the unit cost. Using the weathering values calculated above, **Table 2** shows the cost per ton of hay remaining after storage.

### Storage Options for Round Bales

Bale Binding Materials. Plastic mesh wrap (netwrap) and solid plastic wrap binding materials can be used in place of sisal or plastic twine. Application of these materials costs \$1.50 - \$2.25 per bale but, since they are binding materials, twine cost is reduced about \$0.50 per bale. Both also reduce bale tying time compared with twine. Our research showed that solid, self-adhesive plastic wrap on tall fescue round bales reduced losses to levels not different from bales stored inside. Across two trials, bales stored on

the ground had an average of 4.4" of weathered material. These 5 x 4 foot bales averaged about 0.4 tons each, so the cost per ton for solid plastic would be approximately \$3.75. Disposal of used plastic materials is an environmental and cost factor to be considered.

Inside Storage. The cost of inside storage does not differ greatly from that of some other storage options. Hay sheds adequate to store 250 5 x 4' bales can be constructed for approximately \$7,500. With a ten-year life and 10% interest, the annual cost per bale stored would be \$3.30 at full capacity. More permanent structures should have a useful life much longer than 10 years, thus reducing the per-year cost of storage.

Tarps, Covered Stacks. Tarps can be an economical means of covering stacks of round bales. Bale row covers reduce losses to levels comparable to inside storage if the bales are also elevated off the ground. Hay moisture is a consideration in determining which bales should be covered or stored inside. Research and observations indicate that hay baled at moistures much above 20% and placed in stacks immediately is more prone to molding and heating than would otherwise be the case. Tarps and bale row covers must be secured very well to remain in place during several months of storage.

### **The Value of Forage Quality**

Grinding round bales prior to feeding may encourage the consumption of forage that would otherwise be refused. However, forage quality is also reduced drastically by exposure to outside storage without protection. Numerous auctions of hay on the basis of forage quality indicate that relative feed value (RFV) is valued by hay buyers at approximately \$0.90 per unit per ton of hay. If hay worth \$65 per ton had an RFV of 130, then outside storage of round bales would reduce the value to approximately \$35 per ton based on an RFV loss of 30 units during storage.

**Table 1. Percentage of Bale Volume Affected.**

Bale diameter	Bale width	Depth of weathered layer (inches)			
		2	4	6	8
--feet--	--feet--	-----% of bale volume weathered-----			
4	4	16	31	44	56
5	4	13	25	36	46
6	5	11	21	31	40

**Table 2. Cost of Hay (\$/ton) after Storage Losses for Round Bales.**

Bale diameter	Bale width	Average Depth of Weathered Layer (inches)			
		2	4	6	8
--feet--	--feet--				
4	4	\$59.50	\$72.49	\$89.29	\$113.64
5	4	\$57.47	\$66.67	\$78.13	\$92.59
6	5	\$56.18	\$63.29	\$72.46	\$83.33

Assumes a Production Cost of \$50/ton.