Forages
by Dr. Rocky Lemus

Although winter forages are produced in Mississippi, hay is still the primary source for livestock feeding during the winter. A better understanding of hay losses and quality changes associated with hay storage conditions is critical to reduce feeding costs. Maintaining hay quality after harvest depends on proper storage. Total loss for high quality hay stored outside on the ground could range from 25% to 30%. This dry matter loss from poorly stored hay also translates to dollar values related to the amount of nutrients that have to be supplemented as protein or energy products.

Table 1. Effect of storage method on percent dry matter (DM) loss from large round hay bales.

	Storage Period (months)	
Storage Method	**0 – 9**	**12 – 18**
	——— % DM loss ———	
Ground		
Covered	5 – 10	10 – 15
Exposed	5 – 20	15 – 20
Elevated (pellets/tires)		
Covered	2 – 4	5 – 10
Exposed	3 – 15	12 – 35
Enclosed barn	>2	2 – 5
Under roof (open building)	2 – 5	3 – 10

Source: Huhnke, 2003.

Where to Storage hay?

Most producers in the state are moving in the direction of utilizing round bales instead square bales and they might have limited space for indoor hay storage. It is important to select a well-drained area in the farm where round bales could be stored. Placing round bales in pallets, tires, or gravel minimize dry matter losses (Table 1). Some studies have shown that these techniques reduce storage losses by 15 percent.

These are the not the most recommended methods, but most frequently used by producers with limited storage. These methods are only recommended if the storage period is less than 90 days and daily temperatures are less than 95 °F. In this case, utilizing a tarp is recommended to reduce weathering effects. This reduces dry matter and hay quality losses. Other methods include enclosed barns and roofed-open buildings where the cost of the structure can increase considerably the amount of money invested in hay storage.

Table 2. Percent of dry matter (DM) loss in the outer layer of round hay bales with different diameters.

	Bale Size (ft)[1]				
Outer layer depth (inches)	**4 x 4**	**5 x 4**	**6 x 5**	**7 x 6**	**8 x 6**
	——————% DM Loss ———————				
2	16	13	11	9	8
4	31	25	21	18	16
6	44	36	31	27	23
8	56	46	40	34	31

[1]Bale size = diameter x width.

Source: Huhnke, 2003

When storing bales outside, it is important to place bale rows in the same direction and the prevailing winds, leaving at least 3 ft between bale rows to increase air circulation. Leave at least 2 ft between bales if they are stored side by side. When bales are stored outside, it important to maximize solar exposure to reduce moisture levels; therefore avoid shaded areas close to trees or buildings. Hay stored outside and unprotected often display high weathering and decrease in quality. This weathering process also decreases digestibility and increases fiber content. Storing these bales over longer period of time has shown that up 8 inches of the outer layer could be lost due to weathering (Table 2).

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Some producers might think that this is a small percentage lost, but when it translates to economics, significant amount of money can be lost, especially in years where the drought has a large effect in available forage and hay prices (Table 3 and 4). In 6x6 round bale, a six-inch weathered layer could have a 36 to 38% decrease in digestibility and less available nitrogen (crude protein).

Table 3. Estimated cost of hay after storage lo losses for different round bale sizes.

Average Depth of Weathered Layer (inches)	Bale Size (ft)[1]		
	4 x4	5 x 4	6 x 6
	$/ton		
2	59.50[2]	57.47	56.18
4	72.49	66.67	63.29
6	89.29	78.13	72.46
8	113.64	92.59	83.33

[1]Bale size = diameter x width.

[2]Assumes a production cost of $50/ton

Source: Collins, 1997.

Table 4. Economics of hay lost in storage.

Hay Price	Storage loss (%)[1]							
($/ton)	5	10	15	20	25	30	25	40
	Economic loss ($/Ton hay)							
40	2	4	6	8	10	12	14	16
60	3	6	9	12	15	18	21	24
80	4	8	12	16	20	24	28	32
100	5	10	15	20	25	30	35	40
120	6	12	18	24	30	36	42	48

[1]Loss percentage does not include losses associated with shrinkage or reduced forage quality.

Source: Huhnke, 2003.

For example, consider a 5x4 bale of bermudagrass weighing 1000 lb and stored outside, in the ground, and uncovered. There are 50 bales in the lot. The 4-inch outside layer has been degraded and represents a 30% dry matter loss. This means a 300-lb loss per each 1000-lb bale. Bermudagrass originally contained 10% protein and 58% TDN. Forage quality loss amount to 30 lbs of protein and 174 lb of TDN. If you need to replace TDN with corn at a cost of $6.00 per cwt, the replacement cost is $10.44 per bale of TDN. Replacing protein loses using is soybean at $12.00 cwt will be $3.60 per bale. Due to this losses, additional hay have to be bought to replace losses from storage and feeding. All of these translates to losses of $5 to $8 per bale ($250 to $400 per lot) when hay is properly stored.

Dry matter (DM) loss of dry hay bales is a function of hay moisture, temperature, and how long the hay is exposed to those conditions. To maintain harvest quality as much as possible, it is important that the hay be stored immediately and properly. Investments in storage facilities need a long-term plan to obtain beneficial returns from the infrastructure cost. Low capital storage systems such tarps and elevating the bales to minimize ground contact could be used for a short-term period by producers to offset costs and losses. To reduce loss in hay dry matter and hay quality ensure that: (1) hay is properly cured (<15% moisture), (2) protect the bales from rain and other elements, (3) ensure proper ventilation and air circulation, (4) maintain hay elevated and away from ground level, and (5) check your hay for mold and increasing heat.