Hay Storage and Feeding Options

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Introduction

Cattle producers rely heavily on stored forages to bridge nutritional gaps caused by a decrease in pasture conditions, particularly from fall to spring. Depending on forage management practices and weather, this gap can last between 30 to 120 days, often resulting in an average 90-day feeding season. Producers have two options when it comes to procurement of stored forages. They either grow, harvest and store their own forage crops or purchase them from a commercial hay producer. Either way, stored forages represent a sizeable financial investment.

Meeting a cow's nutritional demand represents approximately 40% or more of the annual production cost of the animal. Producers cannot afford to sustain hay losses, yet that is constantly one of the major profit losses that they face, often unknowingly. With poor management throughout the production cycle, producers can lose up to 70% of their hay crop. Below are some of the ways that losses are suffered in stored forage systems, as well as solutions for how to protect your forage crop. Losses are guaranteed in any stored forage system, but it is the job of the producer to minimize them.

Understanding Hay Loss

Hay is lost at four different time points: field curing, harvesting, storage and feeding. The two points that have the potential for the greatest loss are storage and feeding. Additionally, there are countless factors that influence the amount of hay that will be lost, such as bale shape, bale density, type of forage that was baled, contact with the ground, covered or uncovered storage, twine wrapped or net wrapped, feeding practices and equipment used, etc.

Storage methods will be discussed later to illustrate that the greatest predictor of stored forage quality relates back to how dry the product was kept. Regarding feeding loss, the three main concerns are trampling, refusal and leaf shattering. Some feeding loss is guaranteed. However, the amount of loss seen can be limited through different management practices. Feeding losses can range from 2% to 3% in ideal conditions to upwards of 50% with poor management. The economic impact of hay loss is hard to estimate due to high variability seen from year to year and from location to location. Although the true value is difficult to capture at any given moment, it is easy to see that these losses are a huge challenge and should be managed.

Table 1. Hay harvest, storage and feeding losses.[1]

	Low Management		Strong Management	
	Incremental[2]	Additive[3]	Incremental[2]	Additive[3]
Field Curing	25	25	12	12
Harvesting	15	36	8	19
Storage	35	58	5	23
Feeding	30	71	8	29
Total Loss		71		29

[1]Source: Mike Collins, Mississippi State University.

[2]Losses of dry matter remaining at beginning of each step.

[3]Losses accumulate with each step.

The study referenced in Table 1 measured the percentage of hay loss under low management and strong management. Dry matter loss was recorded at each stage of the production process and is listed as the incremental amount. The additive figure represents the percentage loss of dry matter at each stage of production added together to give a total sum.

Hay Storage

The first decision a producer should make regarding storage is where the hay will be stored. This is an important decision no matter what method of storage will be used. The ideal hay storage site should be slightly elevated, well drained, away from wire fences or trees, and near an all-weather access road. Emphasis should be placed on elevation and drainage when selecting a hay storage site. One of the most detrimental things that can happen to stored forages is for them to sit in standing water for any amount of time. This leads to large amounts of dry matter loss and increases risk of mold and mildew, which can result in animal refusal to consume the forages, as well as cause potential health problems. Select sites away from objects that draw lightning strikes, such as trees and wire fences, in order to reduce the likelihood of losing a crop to fire. Once a haystack fire begins, it moves quickly and is nearly impossible to extinguish.

Another important factor when selecting a hay storage site is an all-weather road since hay will be moving almost year-round. Producers spend the summer months filling their barns and all winter feeding the cattle. It is important to be able to access your haystacks without causing extensive damage to the property. An all-weather road may also serve as a firebreak to protect your hay crops if wildfire were to break out. Producers oftentimes bale hay near where it is stored. Fires due to mechanical failures at harvest are very common and having a road serving as a firebreak may help save stored hay.

Once the storage site has been selected, the producer will have to make the decision on which storage technique to utilize. There are many different storage options, each with their own set of pros and cons. The three main storage methods are uncovered, under a tarp and under a barn.

Uncovered Hay

Uncovered hay storage refers to stacking hay in the open. This is commonly done in a single line that is typically oriented north to south. There are many pros to this method. First, it requires very little financial investment. It is also an easy way to group hay from different cuttings and from different fields. Lots (or individual cuttings) can be stacked in a row with the first bale marked for easy identification. Rows should be placed at least three feet apart to allow for ample airflow. Vegetation around and between rows should be maintained at as low of a level as possible to optimize airflow and expedite drying after rainfall events.

Keeping haystacks uncovered requires very little financial investment. Photo by Tripp Morgan

Haystacks that are oriented north to south experience maximum amounts of sunlight, which in turn helps the bales remain as dry as possible. Generally, in the southeast, the portion of the bale that suffers the most damage with this method of storage is consistently the bottom third due to its contact with the moist ground. This can be mitigated to some degree by stacking the hay on pallets or tires or by investing in a gravel pad to increase drainage and keep the bottom of the bale dryer. Losses associated with storing hay uncovered are highly variable because so many factors influence it.

Bale density plays a large role in minimizing hay losses in an uncovered stack. High density bales shed water more efficiently than low density bales because they create a much tighter thatch across the top of the bale. Another thing that influences the thatch is the forage material that was baled. Fine stemmed grass species form a much tighter thatch that is difficult for water to get through when compared to coarse stemmed grass, such as vaseygrass.

As mentioned previously, bale shape influences dry matter loss, particularly in an uncovered haystack. Skilled operators with good equipment can consistently produce dense bales that are flat on the top with square shoulders. When stacked end to end in a seamless row, these bales fare well against a subtropical climate. Bales that have a slope can funnel rainwater into the unprotected face of the bale that it is stacked against. Bales that are U-shaped provide a place for water to pool and slowly seep into the bale instead of running off quickly.

Tarped Hay

Tarps are a great way to drastically decrease the amount of storage loss experienced without the full expense associated with building a permanent storage structure. Quality tarps can still be a considerable investment; however, they can pay for themselves within a couple of years.

Table 2. Effects of various storage methods on hay losses.[1]

Storage Method	Loss From Handling and Storage (%)	Loss From Animal Refusal (%)
Ground	43	66
Gravel	32	49
Tires	37	43
Wooden rack	31	38
Wooden rack with a plastic cover	12	14
Pole barn	2	3

[1]Source: B.D. Nelson, L.R. Verma, and C.R. Montgomery. Effect of storage method on losses and quality changes in round bales of ryegrass and alfalfa hay. Louisiana. Ag. Expt. Sta. Bull. 750.

Storing under a barn yields the least amount of loss. Photo by Tripp Morgan

A study conducted at the Southeast Research Station in Franklinton, Louisiana, in 1980-1981 compared various storage methods (Table 2). Results showed a 19% improvement in the preservation of dry matter when comparing hay stored on a pallet compared to hay stored on a pallet and covered with a tarp. Likewise, the same principles that improve the preservation rates of hay stored uncovered also improve the preservation rates of hay covered by a tarp.

Drainage is still of utmost importance. You can have your hay protected from above, but if it is sitting in a puddle, you will still experience large levels of loss. Another benefit of storing under tarps is it gives the producer the opportunity to stack vertically. Producers can stack bales in a two-one or a three-two-one pyramid formation when covering with a tarp and store considerably more hay per square foot.

Barn Storage

Barn storage is considered the gold standard. The Southeast Research Station study referenced in Table 2 also evaluated hay losses when stored in a pole barn. The barn stored hay only resulted in a 2% loss. Although there is an up-front cost associated with barn construction, over time it will pay for itself through minimized hay loss. The barn-stored hay retained 41% more dry matter and had 63% less animal refusal at feeding than the hay that was stored uncovered on the bare ground. The increase in dry matter preservation, as well as the increase in consumption, equate to significant economic impact over many years.

Hay Feeding

The three main causes of hay loss at feeding are trampling, refusal and leaf shattering. Hay that is placed out for cattle without a ring or feeder can sustain anywhere from 46% to 60% loss. This is why it is essential to utilize good feeding practices and equipment. Concern over large amounts of hay loss at feeding came about with the adoption of the round baler. Before producers began placing large round bales in pastures, they relied on small square bales that were either placed in a manger or on the sod daily. Feeding smaller square bales limited waste but only allowed the producer to put out what the cows needed for that day. This also forced cattle to fully consume the hay, further reducing waste. Modern round bales allow producers to dispense multiple days' worth of forage with a limited number of bales. While this is a huge timesaver, it lends itself to increased amounts of wasted forage.

One of the simplest ways to combat this issue is to implement hay rings. Different style hay rings have varying levels of effectiveness. A 2021 study by Oklahoma State University evaluated the effectiveness of four different feeder types: an open steel ring, an open poly ring, a sheeted steel ring and a sheeted steel ring that included a basket.

An open-sided poly hay ring can help combat wasted storage. Photo by Tripp Morgan

Table 3. Effects of feeder design on hay waste, orts[1] and disappearance.[2]

	Hay Feeder Design				
Item (and Design)	**Steel (Open)**	**Poly (Open)**	**Sheeted**	**Basket (Sheeted)**	**P-Value**
Number of Bales Measured	8	8	8	8	
Bale DM wt., lbs	1,369	1,400	1,349	1,329	0.15
Total Waste, % of bale DM	19.7	21.1	12.4	5.5	<0.01
Orts, % of bale DM	6.49	4.62	7.18	26.6	<0.01

[1]Orts = hay dry matter (DM) remaining inside the feeder 96 hours after bale introduction into the paddock.
[2]Source: Sexten et al., 2021.

Total waste ranged from 5.5% to 21.2%, depending on the type of hay feeder that was selected. Regardless of which type of feeder the producer selects, it is important to remember that the feeder must be moved periodically to prevent damage to the sod, reduce compaction and evenly disperse urine and feces. Strategic winter feeding across subfertile pastures and hay meadows is an excellent way to return organic matter to the soil profile.

If the producer is averse to implementing hay feeders, one method that can be employed is to limit the amount of hay fed to what is required for one day. This encourages the cattle to consume what is provided for them. Regardless of what feeding techniques are being used, there is no replacement for observation. If you are experiencing losses due to refusal, you need to determine why. If you are experiencing losses because too much forage was put out at one time and an unacceptable amount was trampled, you will need to adjust. These are examples of management challenges that can only be captured by observation.

Summary

In conclusion, of the four points in time where dry matter loss is seen in stored forages (field curing, harvesting, storage and feeding), the greatest potential for loss is during storage and feeding. Fortunately, these are the two easiest to manage. When it comes to storage, select the method that is most impactful and feasible for your operation and individual locations. Reach out to your local LSU AgCenter Extension office for more information and help deciding which option best fits your operation.

References

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