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Economics of Hay Storage in Tennessee

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Introduction

For Tennessee livestock producers, hay is one of the largest input costs in a cattle operation. In Tennessee, producers need hay at various times throughout the year, with most feeding occurring between November and March when grazing is limited. A key decision producers face is not just how much hay to have on hand but how to store it. Improper outdoor storage can result in up to 40 percent losses within a single year in humid environments like Tennessee (Pedreira, 2023). That means for every ten bales stored outside, a producer loses the equivalent of four bales in forage mass and nutritive value.

A key constraint hindering the adoption of hay storage facilities is that they are large capital investments. In Tennessee, the Tennessee Agriculture Enhancement Program (TAEP) helps offset that capital investment through a cost-share program. As of 2026, TAEP reimburses livestock producers 50 percent of eligible costs up to a maximum of $8,000, meaning the full 50 percent rate applies to facilities costing up to $16,000. Facilities costing more than $16,000 still receive the $8,000 maximum regardless of total cost. This publication covers the costs and returns of on-farm hay storage and how TAEP's cost-share program affects the return on that investment for Tennessee livestock producers.

Why Does Hay Storage Matter

Having an adequate quantity of hay for a feeding window can be achieved in different ways, but the cost of that hay depends heavily on how it is stored. Hay storage has become a key factor in maximizing forage use efficiency while minimizing economic losses from poor storage.

There are four primary storage methods, each with different loss rates and costs:

1. **Outdoor storage.** Hay stored outside with no protection is exposed to moisture, sunlight and ground contact. Hay losses can reach up to 40 percent within a single year in Tennessee's humid climate (Pedreira, 2023). Decreased hay quality from improper storage also reduces voluntary intake by ruminants, compounding economic losses beyond simple dry matter losses (McGechan, 1990).

2. **Tarp storage.** Covering hay with a tarp reduces exposure but does not eliminate it. Hay losses under tarp storage are below 20 percent (Pedreira, 2023). This is a cheaper option for preserving hay, but it still results in meaningful feed loss.

3. **Wrap Storage.** Some producers also wrap dry bales in plastic film, which can achieve storage losses slightly better than tarp storage but can result in surface mold from condensation under the wrap. Because shed storage is the primary TAEP-eligible investment addressed in this publication, the economic analysis focuses on the comparison between covered shed storage and unprotected outdoor storage.

4. **Shed storage.** A covered hay storage facility is the best-case scenario for preserving nutritive value, with losses of approximately 5 percent (Musgrave and Kennedy, 1950). Shed storage is the most expensive option upfront but generates the greatest long-term economic return through reduced feed replacement costs.

The Cost of Improper Storage

The economic case for covered hay storage rests on the feed replacement costs imposed by forage mass and nutritional losses (Clary and Reeves, 1990). To understand the economic benefit of a hay storage facility, producers need to compare what it costs to meet their herd's nutritional needs with and without a barn.

Because hay loses forage mass and nutritive value in storage, a producer storing outside must purchase or produce more bales to deliver the same nutrition to their herd. A producer with a shed needs fewer bales to meet the same requirement. The difference in what a producer spends to meet the same nutritional need is the feed savings generated by the facility.

To illustrate how storage losses translate into real costs, consider a producer who needs to deliver 200 bales of nutrition to their herd over the winter. Because outdoor storage results in 40 percent dry matter and nutritive losses, that producer must start with significantly more bales to end up with the same nutrition delivered. A producer with a shed loses only 5 percent, meaning far fewer bales are required.

Table 1. Bales Required to Deliver 200 Bales of Nutrition by Storage Method

	Outdoor Storage	Shed Storage
Loss rate	40%	5%
Bales Required to Deliver 200 Bales of Nutrition	333	211
Extra Bales Needed Compared to Shed	122	--
Cost of Extra Bales at $30/bale	$3,660	--
Cost of Extra Bales at $45/bale	$5,490	--
Cost of Extra Bales at $60/bale	$7,320	--

A producer storing outside must purchase or produce 122 additional bales per year simply to compensate for storage losses, at a cost of $3,660 to $7,320 depending on hay price. This over the expected 25-year lifespan of a hay shed can range from $91,500 to $183,000.

The economic benefit of a hay storage facility is calculated as:

Economic Benefit = Feed Savings − Annual Facility Payment After TAEP

Where feed savings are the difference in cost between meeting nutritional needs with outdoor storage versus shed storage, and the annual facility payment is the producer's out-of-pocket cost divided by the expected lifespan of the facility.

TAEP and Hay Storage Investment

TAEP reimburses livestock producers 50 percent of eligible costs up to a maximum of $8,000. Because the reimbursement is capped at a flat dollar amount, the share of total facility cost reimbursed varies with the size of the investment. Smaller facilities receive a proportionally larger share of their total costs reimbursed compared to larger facilities. Table 2 illustrates how the reimbursement share changes across facility sizes.

Table 2. Bales Required to Deliver 200 Bales of Nutrition by Storage Method

Facility Size	Total Cost	TAEP Reimbursement	Producer Cost	Reimbursement Share
Small ~200 bales	$13,000	$6,500	$6,500	50.0%
Average ~364 bales	$22,160	$8,000	$14,160	36.1%
Large ~655 bales	$50,000	$8,000	$42,000	16.0%

Source: TAEP participant data,2025

Regardless of facility size, TAEP meaningfully reduces the annualized facility payment that must be recovered through feed savings. Assuming a 25-year facility lifespan, the annual payment after TAEP ranges from $260 for a small facility to $1,680 for a large facility, a modest cost relative to the feed savings generated in most scenarios.

What Drives Returns

Two factors drive the economic return from a hay storage facility more than any other: **utilization rate** and **hay price**.

1. **Utilization.** A facility that sits partially empty significantly reduces the return on investment. The more bales a producer stores in the shed relative to its capacity, the greater the feed savings generated. Producers should size their facility to match realistic production or purchasing volumes.
2. **Hay price.** The higher the price per bale, the greater the savings from avoiding hay loss. During drought years when hay prices spike, the economic return from proper storage is at its highest, exactly when having adequate stored hay matters most.

Table 3 illustrates the net economic benefit across three facility sizes and three scenarios combining utilization rate and hay price. The best-case scenario assumes 100 percent utilization at $60 per bale, the baseline assumes 75 percent utilization at $45 per bale, and the worst-case scenario assumes 25 percent utilization at $30 per bale. Calculations assume each 5x5 bale occupies approximately 110 cubic feet of shed space and a 25-year facility lifespan.

Table 3. Annual Net Economic Benefit from Hay Storage by Facility Size and Scenario

Facility Size	Bale Capacity	Annual Payment	High Cost, High Utilization ($60, 100%)	Baseline ($45, 75%)	Low Cost, Low Utilization ($30, 25%)
Small	200	$260	$7,108	$3,885	$661
Average	364	$566	$12,844	$6,976	$1,111
Large	655	$1,680	$22,452	$11,888	$1,341

In short, the bigger the shed and the higher the utilization rate, the more profitable the shed can be for the producer. Proper storage adds measurable economic benefit through both net return and preserved hay value. Across all facility sizes and scenarios, hay storage generates a positive net economic return, even in the worst case of 25 percent utilization and $30 per bale.

To put these annual returns in perspective, Table 4 shows the cumulative feed savings over the expected 25-year lifespan of the facility at the baseline scenario. Just as a producer storing outside pays $91,500 to $183,000 in unnecessary bale costs over 25 years, a producer with a shed captures those same savings and puts more back into their operation.

Table 4. Cumulative Feed Savings Over 25-Year Facility Lifespan (Baseline: 75% Utilization, $45/bale)

Facility Size	Annual Net Benefit	25-Year Cumulative Savings
Small (200 bales)	$3,885	$97,125
Average (364 bales)	$6,976	$174,400
Large (655 bales)	$11,888	$297,200

Source: Collins (2026), based on TAEP participant data. Annual facility payment after TAEP reimbursement assumed over 25-year straight-line depreciation.

Recommendation

On-farm hay storage is a worthwhile investment for most Tennessee livestock producers when facilities are adequately utilized. Hay storage generates a positive net return in every scenario examined, and the annualized facility payment after TAEP is low enough that feed savings cover it comfortably across all facility sizes. However, the size of the return depends heavily on how the facility is used. While tarp storage and plastic wrapping of dry bales offer intermediate levels of protection compared to outdoor storage, the analysis and recommendations below focus on covered shed storage as the TAEP-eligible investment decision.

Producers considering a hay storage investment should evaluate the following:

- **Utilization.** A facility that sits partially empty significantly reduces the return on investment. Producers should size their barn to match realistic hay volumes, whether purchased or raised on farm.
- **Hay price.** The economic return from storage is greatest when hay prices are high. Producers who routinely buy hay during low-price periods and store it for later use can capture additional savings beyond hay preservation alone.
- **Facility lifespan.** A well-constructed shed can last 25 years or more, spreading the capital cost over a long period and improving the annual return on investment.
- **TAEP cost-share.** The reimbursement meaningfully reduces the facility's annualized cost and improves the return on investment across all barn sizes. Producers should apply through the Tennessee Department of Agriculture before construction begins, as reimbursement is not available for facilities built before approval.

Conclusion

Hay storage is a consequential investment for Tennessee livestock producers. Improper outdoor storage can result in up to 40 percent hay losses, forcing producers to purchase or produce additional bales to meet their herd's needs at high cost. A covered hay storage facility reduces those losses to less than 5 percent, generating meaningful feed savings that exceed the annualized facility cost in every scenario. TAEP's cost-share program reduces the capital barrier to entry and improves the return on investment for producers of all sizes. Producers who store hay strategically, size their facility to match realistic utilization and take advantage of TAEP reimbursement are well-positioned to reduce their overall feed costs and improve the long-term profitability of their operation.

For more information, refer to:

Ball, D.M., Hoveland, C.S., and Lacefield, G.D. (2015). Southern Forages: Modern Concepts for Forage Crop Management (5th ed.). International Plant Nutrition Institute, Atlanta, GA

Clary, G.M., and Reeves, S. (1990). Investing in Hay Storage Facilities.

Musgrave, R.B., and Kennedy, W.K. (1950). Preservation and storage of forage crops. Advances in Agronomy, 2, 273-315.

Tennessee Agriculture Enhancement Program (TAEP). tn.gov/agriculture/farms/taep.html.



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