

# How Do Hay Bales Stack Up?

BY TROY SMITH



TROY SMITH PHOTOS

“The new-generation balers turn out good, dense bales when forage is put up correctly,” says Dale Blasi. “Significant losses to hay quality occur because big bales are subjected to adverse storage conditions. With just a little extra effort, losses might be reduced considerably.”

For much of the Plains area it's been a good year for hay production. At least there seems to be plenty of it — particularly alfalfa. Last year, too, yielded a generous crop, but the region's relatively easy winter allowed cattle herds to graze crop residues and winter ranges to the fullest. Since many producers fed less supplemental hay, considerable carry-over supplies remained stockpiled in farm fields. Add in an ample new crop, and we see ricks, rows, stacks and piles of hay everywhere.

Dairy producers and commercial hay growers often store their premium-quality hay under roofs, and hay barns are common in higher-rainfall areas of the eastern United States. It's safe to say, however, that a majority of cattle producers store hay outside, under the sky.

Big round bales have become the most common hay-packaging system, and producers arrange bales in a variety of ways for outside storage. Apart from the occasional nondescript “heap,” three arrangements are most common. One involves placing bales single file, end to end, in a row. Producers preferring to cover less real estate may stack bales in pyramid fashion, while another two-tiered

stacking method involves standing bottom-tier bales on end, then “capping” them with top-tier bales placed sideways.

Which method is best? The answer may depend upon the period of time that bales might be in storage and what type of equipment producers will use to transport and to feed the hay. For example, if hay is to be sold or loaded and moved to another storage site before it is fed, certain bale-stacking techniques may facilitate more efficient transport.

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## ■ Effect on hay quality

For the purpose of this article, however, let's look at how storing big round bales outdoors might affect hay quality. Even a novice can understand that exposure to the elements will cause loss of quality, both in nutrient value and in palatability. So let's concentrate on things the experts list as considerations for minimizing hay losses during storage.

Cliff Lamb, assistant professor of animal science at the University of Minnesota, says most producers don't realize how large their losses really are. According to Lamb, one method to determine to what extent hay losses occur is to monitor dry-matter losses.

For round bales stored outside on the ground for one season, losses commonly average 25%. In general, coarse-stemmed forages are more vulnerable to storage losses than fine-stemmed hay. Regardless of hay type, the greatest spoilage is created where bales contact the ground, due to wicking of moisture from the soil.

However, weathering and loss of quality certainly occur over the entire exposed surface of bales stored outside. Losses are greater than commonly understood due partly to the shape of the package. Lamb says a weathered layer on the surface of a round bale can represent a significant amount of hay. A layer 4 inches deep over the entire surface (including the ends) of a bale measuring 4 feet in diameter represents nearly one-third of the bale's total volume. The following table illustrates how depth of weathering can affect bales of various sizes.

**TABLE 1: Percentage of bale volume affected**

Bale Diameter	Bale Width	Depth of Weathered Layer			
		2 in.	4 in.	6 in.	8 in.
4 ft.	4 ft.	16%	31%	44%	56%
5 ft.	4 ft.	13%	25%	36%	46%
6 ft.	5 ft.	11%	21%	31%	40%

**Source:** *Pastures for Profit: A Guide to Rotational Grazing*, Minnesota Extension Bulletin A3529

“In a study at the Research and Outreach Center in Grand Rapids, we utilized an alfalfa/grass-hay mixture to determine the effect of various stacking procedures on spoilage and changes in relative feed value,” says Lamb. “When uncovered bales were stacked in single rows exposed to the weather, spoilage was greater than 25% both on the bottom and top of each bale. For bales stacked in a pyramid (two bottom rows and one row on top), overall losses appeared to be similar to bales placed in a single row. These losses matched those seen in a two-bale row where one bale is placed on top of a bottom bale turned on end.”

#### ■ Protective covers

“When a single wrap of netting is used to cover each bale, we begin to see the effects of stacking procedure. Wrapped bales placed in single rows exhibited similar losses to pyramid-stacked bales where bales had contact with the ground. However, aboveground spoilage was less for single-row bales than for bales stacked in a pyramid. Additional spoilage, from 7% to as much as 29%, of the latter is attributed to a collection of water between the upper bales and the bales below,” Lamb relates.

If bales are stacked for storage, Kansas State University Extension

## Recommendations for outside hay storage

1. Select a bright, sunny storage location without trees or other objects nearby to attract lightning. A well-drained, gently sloping site with a southern exposure is recommended.
2. Avoid contact between hay and soil by placing bales on rock, wooden pallets or another barrier to prevent bales from wicking moisture.
3. Bales placed in rows should have flat ends butted tightly together. Rows should have north-to-south orientation and run up and down the slope.
4. When storing multiple rows, don't allow rounded sides of bales to touch. Allow at least 3 feet between rows.
5. Additional storage losses may be reduced by bale netting or sleeves or by covering the tops and sides of bales with plastic or commercially available covers. Covering is particularly advisable for bales stored in multilayered stacks.

Beef Specialist Dale Blasi says producers may want to consider protecting the bales with some type of covering. The expense and labor associated with applying plastic sheeting or one of numerous commercially available coverings may be most easily justified when groups of bales are placed under one cover. Individual bale covers are most suitable for producers who use relatively small quantities of hay in a given feeding season.

When considering bale-protection strategies, whether coverings

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## Three most common arrangements for storing bales outdoors



1. Stacking bales in pyramid fashion.



2. Single file, end to end, in a row.



3. Bottom row set on end, then capping with top tier.

or construction of storage barns, the economic feasibility must be determined by comparing protection costs with an estimated value of hay losses without protection.

■ **Outdoor recommendations**

When uncovered outside storage seems most feasible, Blasi recommends storing bales in rows with flat ends firmly butted together. If possible, rows should run north and south, so as to allow maximum exposure of the rounded sides to the sun. The sides of bales should not touch to avoid creating moisture-holding areas. Blasi advises leaving at least 3 feet between rows to ensure sunlight penetration and air circulation. A gently sloping storage site is best, preferably with a southern exposure. Bales should be oriented up and down the slope to avoid damming surface runoff.

According to Blasi, data suggest that 50% or more of losses associated with outside storage occur where the hay touches the

ground. Therefore, it may be more important to protect the bottoms, as opposed to the tops, of bales. That means holding bales away from the soil surface with something that does not trap and hold water. Methods are limited only by producer imagination and ingenuity, and they may include wooden pallets, poles or railroad ties. A bed of rock or coarse gravel also reduces wicking of moisture by bales stored on the ground.

“The big round bale is a product of a labor shortage in agriculture. One person can bale up what a whole hay crew used to handle, and do it faster,” says Blasi. “Unfortunately, our overall hay quality is poor, but it’s not because of the equipment. The new-generation balers turn out good, dense bales when forage is put up correctly. Significant losses to hay quality occur because big bales are subjected to adverse storage conditions. With just a little extra effort, losses might be reduced considerably.”



## Minimizing hay-feeding losses

It’s not uncommon for hay-feeding losses to be as great as losses due to storage. The two often are related since greater weathering and spoilage means increased animal refusal. Other feeding losses result from leaf shatter, trampling and fecal contamination. Levels and costs of these losses vary with feeding method, feeding interval, amounts fed, number of animals and weather conditions.

While feeding losses of 3%-6% are considered acceptable for most operations, losses of more than 60% have been observed. Low levels of loss normally are associated with feeding systems requiring higher labor inputs and daily feeding.

Nutritive analysis of hay allows supplies to be separated according to quality and matched to classes of cattle, with

respect to different nutritional requirements. For example, the highest quality hay might be fed to growing calves, bred heifers and lactating cows. Lower quality hay might be adequate to meet the needs of dry, pregnant cows and bulls being maintained between breeding seasons.

Large hay bales are most commonly fed on sod, which offers the advantage of distributing hay over a larger area rather than concentrating it along feedbunks or barns. Some producers prefer to feed in a single convenient location to minimize the size of the area that may be damaged by feeding activity. Others prefer to move the feeding area frequently to spread manure and reduce the severity of damage to any one area.

Wherever the hay is fed on sod, the amount of hay wasted will be less when only a one-day supply is provided. Unrestricted access to large round bales nearly always results in excessive waste. Forcing animals that have low nutritional requirements to clean up hay in feeding areas before more hay is provided also helps reduce waste.

While the least expensive feeding method is to simply unroll a bale, feeding losses may be lowered by grinding hay to facilitate limit feeding and to reduce the ability of animals to eat selectively. However, costs associated with additional hay processing and feeding equipment (feeder wagon, bunks, etc.) required for feeding must be weighed against the value of recovered feeding losses.



**When considering bale-protection strategies, whether coverings or construction of storage barns, the economic feasibility must be determined by comparing protection costs with an estimated value of hay losses without protection.**