Shelter from the Storm

Hay barns offer refuge from staggering feed losses.

by **Crystal Albers**

Hay is the most common — and often the most expensive — stored feed for many livestock operations. Therefore, when hay supplies are threatened by weather conditions and other environmental factors, producers risk facing a bleak forecast.

According to "Minimizing Losses in Hay Storage and Feeding," a collaborative publication released in 2001 by five university Extension specialists, U.S. producers annually turn out more than 150 million tons of hay, worth more than $12 billion — $3 billion of which is later lost due to inadequate storage and feeding techniques. Such losses account for a large portion — more than 10% in some cases — of total livestock production costs, says Don Ball, Auburn University Extension agronomist and publication co-author. "Most of these storage losses occur in areas where hay is stored outside without protection," he says.

Leaving hay exposed to the elements allows it to weather, which quickly degrades chemical composition and feed value, while decreasing palatability. The longer hay is exposed to unfavorable conditions, Ball says, the greater the loss.

Fortunately, a variety of storage options are available. Various types of storage facilities, plastic sheeting and tarps remain popular options. For hay stored outside, stacking techniques, site selection, and bale type and density also influence hay quality and weathering resistance. Ball suggests producers choose wisely among these systems. According to the publication developed by Ball and others, the method of hay storage can make the difference between less than 5% or more than 50% dry-matter (DM) loss in some high-rainfall areas.

Although the right storage method varies with each producer and location, Ball says hay barns offer the most protection from weathering and DM loss in nearly every case.

"The percentage of loss is almost always lower from barn-stored hay than from any other technique," he says. "Once you put it in a barn at a safe moisture level and it's protected from the elements, you don't lose much from there on."

Seek shelter

"Storing hay in a barn really is the best way to store it, but the feasibility of building a barn depends on several factors," Ball says. "One is the value of hay."

Oklahoma State University (OSU) Agricultural Engineer Raymond Huhnke echoes the sentiment, suggesting producers evaluate desired quality and cost, as well as how much hay they will

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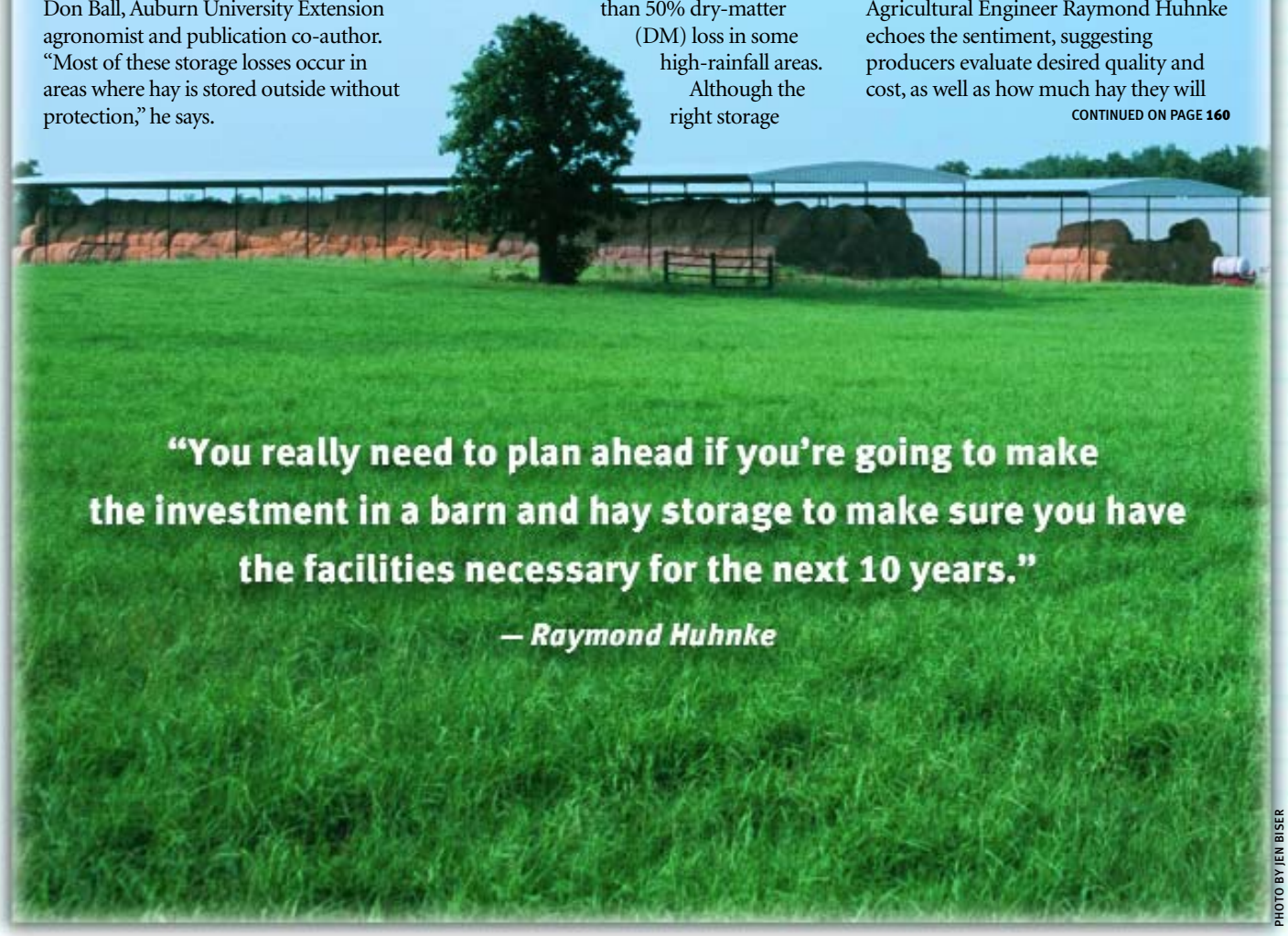

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► **Above:** Bale dimensions, stack height and length of time hay will be stored will help determine building type and dimensions.

need to maintain their herds throughout the year.

"It also depends on how long you're going to have the structure," Huhnke says. "[A hay barn] is a long-term investment. You need to look at your operation and determine how much and how high quality hay you need. If it's low- or medium-quality hay that you need, it's going to be difficult to justify building a structure in which to store it. It really depends on how you're going to be using it."

"In cases where you might be selling the hay, how much money you get for the hay can be greatly affected by its appearance and quality," Ball adds.

Both Huhnke and Ball suggest producers study hay budgets to determine the actual cost of hay production and the dollar value of hay storage losses. Once a producer decides to construct a hay storage facility, it's important to consider every detail prior to construction.

"You really need to plan ahead if you're going to make the investment in a barn and hay storage to make sure you have the facilities necessary for the next 10 years," Huhnke says.

Battling the elements

There are many elements to consider when building a hay storage facility. Initial costs will depend on building style, material costs and labor, as well as depreciation of the building, repairs, taxes and insurance.

"Cost of erecting a barn can vary tremendously, depending on where you are, whether you do it yourself or hire it done, and what type of structure you build," Ball says. "There's a huge range of costs."

Huhnke estimates producers can expect costs to range from $3 to more than $10 per square foot (sq. ft.). Again, the figure will depend on the structure's dimensions and number of sides as well as who builds the facility.

Bale dimensions, stack height and the length of time bales will be stored will help determine dimensions of the building, which can be constructed in a variety of ways, from open sides to completely enclosed storage.

"Obviously, the fewer materials you use, the cheaper it will be," Ball says. "For most producers who are going to use a barn for nothing but hay, [the barn] probably does not have to be enclosed on all sides or even on any side." The main objectives, he says, are to remove the hay from contact with wet soil and to prevent the hay from getting wet on top.

"A lot of producers have hay barns that don't have any sides or just one side to protect against prevailing winds," Ball says.

"Just make sure the barn is designed to withstand wind loads for your particular area," Huhnke suggests. "Naturally, if you have an open side, make sure it's open to the direction least likely to catch rainfall or snow." For Oklahoma and most parts of the Midwest, for example, barns would need to be open to the east and designed to withstand wind loads of up to 80-90 mph, Huhnke explains.

The building should also be located on a well-drained site near the feeding area, and it's important to make the barn large enough (in both length and height) for current and future storage needs.

Certain building dimensions work better for round bale storage, Huhnke adds. For example, as indicated in an OSU fact sheet, a 24-ft.-wide building will not provide adequate space for four 6-ft.-diameter bales placed side by side since stated dimensions

Table 1: Large round bale storage capacities

	Vertical stack[a]				Pyramid pattern[a]			
	5-ft. diameter × 5 ft.		6-ft. diameter × 5 ft.		5-ft. diameter × 5 ft.		6-ft. diameter × 5 ft.	
Building size	2-high	3-high	2-high	3-high	2-high	3-high	2-high	3-high
	number of bales		number of bales		number of bales		number of bales	
26' × 64'	110	165	88	132	99	132	77	99
32' × 64'	132	198	110	165	121	165	99	132
36' × 64'	154	231	—	—	143	198	—	—
38' × 64'	—	—	132	198	—	—	121	165
42' × 64'	176	264	—	—	165	231	—	—
44' × 64'	—	—	154	231	—	—	143	198
46' × 64'	198	297	—	—	187	264	—	—
50' × 64'	—	—	176	264	—	—	165	231

[a]Assumes about 4 ft. of unused space at one end.

Source: Raymond Huhnke, "Round Bale Hay Storage," OSU Extension sheet F-1716.

General recommendations for barn storage

1. Open-sided barns should generally be oriented with the long axis east and west to minimize the amount of sun intrusion into the building.
2. If only one side of the barn is open, it should be facing away from prevailing wind to minimize rain being blown into the barn.
3. All buildings should meet building code requirements.
4. Sidewalls add protection to both equipment and hay, but add significantly to the cost of the building. You should get a bid on different types of buildings and do your own analysis.
5. Buildings for hay storage should be as open as possible in the gable ends (peak of the roof) to allow moisture to escape as the hay dries while in the barn. Otherwise, condensation and rust will occur on the inside of the roof. Ridge vents should also be considered in large barns.
6. More large round hay bales can be stored in a barn by stacking the bales on their (flat) end rather than on their (round) side. This can be done with a 4-foot (ft.), front-end-loader fork. It does, however, take a little more time and effort than storing on the side.
7. Make sure the eave height (vertical clearance) of your barn is high enough to fit your needs (usually at least 14 ft.). Nothing is more frustrating than realizing that one more foot of ceiling height would allow you to put another layer of hay bales in the barn or that your barn is 1 ft. too short for the new combine.

Source: John Worley, University of Georgia (UGA) Extension engineer and William Givan, UGA Extension economist, "Economics of Farm Storage Buildings."

are usually exterior measurements. (See Table 1 for specific building dimensions based on number of bales stored.) Huhnke also suggests barns feature clear-span storage, which doesn't require interior poles that may get in the way of hay movers.

Safety should always be a consideration, Ball adds.

"The main consideration is stacking it in such a manner that it will be an efficient use of the space," Ball says. "But also make sure to stack bales in such a way that they won't fall."

Fire risk is another safety hazard to consider. "One issue that always arises is hay moisture and the potential for hay fires and the loss of a barn," Huhnke says.

Producers can help avoid hay fires by storing hay in barns at appropriate moisture levels. Ball sites recommendations available in the Extension publication — round bales should be stored at no more than 18% moisture levels. Small rectangular bales shouldn't contain more than 20% moisture.

For other safety and construction recommendations, both Huhnke and Ball suggest seeking out barn plans available at some land-grant universities. "Extension agents are also helpful, and you can get feedback from other people who have been through it," Ball adds.

Clear skies ahead

Of course, hay storage structures might not be the right fit for everyone.

"In some situations, even relatively brief outside storage in climates such as Alabama can result in substantial losses," Ball says. "But you can store hay outside in the desert in California and not worry about it. If you store a loose type of hay or porous bale in Alabama, though, you'll get a lot of damage very quickly."

Climate, forage species, available resources, cost, labor and time are all considerations that need to be carefully examined, he says, directing producers to the "big picture."

"It's important to minimize hay losses, but also to minimize the amount of hay you use in your livestock operation," he says. "In reality, the concept of protecting hay is a strategy for reducing hay needs. The No. 1 goal is to try to get by with as little hay as you can, and No. 2, protect the hay you do have to have."

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