



FORAGE FACTS

Publication Series

STORING LARGE ROUND BALES OUTSIDE

INTRODUCTION

One of the most economical hay production packages is large round bales. This is primarily because of low labor requirements. A survey of farmers in south central Kansas found that 72 percent used large round bales as their primary hay package. The survey also revealed that almost 60 percent of respondents store all hay unprotected in large round bales outside.

Baling a well-formed, dense bale is the first step toward minimizing storage losses through improved handling ability and storage. Moisture content at baling also plays an important role. If hay is too wet, quality could decrease due to heating. However, baling too dry could cause baler losses to increase dramatically. Round bales should be baled at moisture contents ranging from 15 to 20 percent. The ideal moisture content for large round bales is about 17 percent.

Storage method and length of storage period have a tremendous impact on weathering losses. Barn-stored hay suffers significantly less weathering loss than unprotected hay stored outside. Dry matter losses for barn-stored hay are typically in the 2- to 8-percent range. Covering outside stored hay can also reduce weathering. The longer hay is stored, the higher the losses. Hay stored outside will continue to deteriorate as long as it is stored, however most spoilage will occur early in the storage period. Hay stored in barns for long periods will also continue to deteriorate, though the rate is much slower. Large round bale storage losses can easily exceed 25 percent when bales are stored outside, unprotected in Kansas, but losses can be minimized through good management. If outside storage is the chosen method, pay close attention to selecting a storage site and stacking method.

CHOOSING A STORAGE SITE

A well-drained site minimizes deterioration on the bottom of the bale. Bales stored on damp soil absorb moisture that causes subsequent damage. If possible, elevate bales by stacking on old tires, shipping pallets or railroad ties. Adding a base layer of 3- to 4-inch crushed rock to the storage site will help minimize losses at the bottom of bales. Weeds or tall grass at the storage site will increase deterioration of the bottom of the bale. Storing bales on the ridge of a hill instead of near the bottom will also reduce bottom deterioration.

Round bales stored outside need air circulation and sunlight to help dry the outer layer after a rain. Storing the bales under trees blocks wind circulation and sunlight, which helps dry the bales. Any protection

that trees might offer from rain is more than offset by the damage due to the shading they provide.

STACKING METHOD

There are a wide variety of methods for stacking large round bales. This publication will discuss the methods in three categories.

Individual Bales. Bales are sometimes stored individually without touching other bales for ease of handling with equipment that grabs the bale from both ends. If bales are stored individually, leave at least 18 inches between bales for air circulation. Storing bales with the rounded sides touching is not recommended. This creates a trap for rain and snow. The bales may be easier to handle with some equipment, but losses will be higher.

End to End. Tightly stacking bales end to end better utilizes storage area and protects the ends of bales from weathering. If bales are not stacked tightly against each other, rain could penetrate the ends and increase damage.

Aligning rows north-south allows an equal amount of sunlight on both sides of the bale row which results in more uniform drying. Leaving at least 3 feet between rows allows air to circulate through and sunlight to reach bales. The increased distance between rows reduces the chance of snow accumulation on the bales. If snow accumulation is a possibility, stack rows further apart. The greater distance allows sunlight to melt the snow sooner and reduces weathering losses from the snow.

Table 1 shows dry matter and quality losses associated with weathering for different stacking methods for alfalfa and brome hay storage in Kansas. Though this study found no significant differences between north-south versus east-west row alignment, the former is the preferred method. Quality losses on the north side of the east-west row exceeded those on the south side of the row. The bales used in the study were fairly dense and well formed, which again indicates that minimizing hay storage losses begins at baling. It also indicates that site selection is more important than row orientation.

Stacks. In the past, storing bales in pyramids has been the most popular way to stack large round bales. This is a good way to make the most of minimal storage space, however, if bales are not covered, weathering losses can be devastating. A South Dakota study reported dry matter losses in prairie hay stacked in pyramids at over 10 percent for one year of storage. Dry matter losses in the same study were 4 percent for bales stacked individually and less than 1 percent for bales stacked end to end.

Another method for stacking bales that is becoming popular in Kansas is to turn one bale on end and stack another on top of it. This method has been referred to as the "Canadian" method, though the source

of this name is unknown. A K-State Research and Extension study indicates that this could be a feasible stacking method (Table 1). Dry matter and quality losses from bales stored in this manner were similar to those of bales stored end to end in north-south and east-west rows. Hay spoilage at the bottom of the bale was higher for this method, but less hay is exposed to the ground. High density, well-formed bales tied with plastic twine or net are necessary for bottom bales in these stacks. Sisal twine is not recommended since it can rot, causing bales to fall apart.

COVERING BALES

Covering bales offers some promise for reducing weather-related losses for bales stored outside. However, covering bales does have drawbacks. First, if a low-quality cover is used, it may be difficult to keep it on the bale. Wind damage can be devastating for plastic tarps. Any tears must be repaired immediately if the cover is to remain in place. Covers also need to be anchored to the ground or stacked to keep them in place. Reinforced plastic sheeting is more expensive, but will probably require less maintenance and last longer.

Covering bales with plastic will trap moisture the same as wrapping them in plastic. If high moisture hay (over 18 percent) is sealed under plastic, quality losses can result from excessive heating and mold development. Condensation of moisture at the top of the stack could also cause spoilage in high moisture hay. Stacking bales in pyramids before covering minimizes costs associated with the cover, by allowing a tarp to cover more hay.

Table 1. Average dry matter losses for storage sites and stacking methods for alfalfa and brome hay.

| Stacking Method | Rooks County (alfalfa) | Wabaunsee County (brome) |
|-----------------|------------------------|--------------------------|
| E-W Rows | 9.8% | 11.0% |
| N-S Rows | 10.1% | 14.1% |
| Stacked | 7.9% | 11.6% |

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