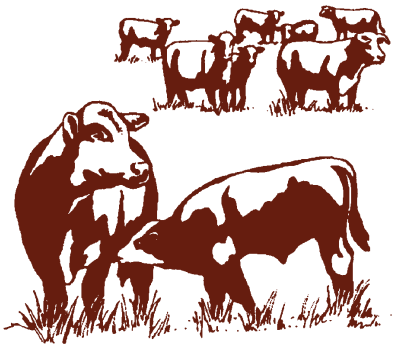

# Beef Cattle Handbook

**BCH-7310** Product of Extension Beef Cattle Resource Committee

## Management to Minimize Hay Waste

Terry Mader, Extension Beef Specialist, University of Nebraska
Bruce Anderson, Extension Forage Specialist, University of Nebraska
Dave Sanson, Ruminant Nutrition Specialist, University of Wyoming

Hay is harvested, stored, and fed under a wide variety of conditions that influence both its yield and quality. Harvest and storage involve both dry matter and nutritive value loss. These losses occur in all phases of getting the hay from the field to the livestock — harvest, storage, and feeding.

### Harvest

After cutting, forage plant cells respire until their moisture content falls below 35 - 40 percent. Hay dries rapidly on a warm, dry, breezy day resulting in dry matter losses to respiration of only 2 - 6 percent. If hay dries slowly, however, dry matter losses to respiration can be as high as 15 percent. This can happen when hay is rained on soon after cutting or when soil moisture and humidity levels are high. Overnight losses from hay cut in late evening can be as high as 11 percent. Respiration loss is due primarily to the breakdown of soluble carbohydrates, which are roughly 100 percent digestible. Therefore such losses will substantially reduce hay quality. Losses during curing cannot be eliminated, but cutting hay when good drying weather is expected will reduce respiration losses considerably.

Once the moisture content of hay falls below 35 - 40 percent, most harvest losses are caused by weathering and handling. Weathering losses, primarily losses to leaching, increase with the number of rain showers, amount of rain, and dryness of the hay. Leaching can cause yield losses as high as 20 percent. Most of the lost nutrients are highly-digestible solubles (carbohydrates, proteins, B vitamins, and some soluble minerals, such as potassium). Rain not only leaches nutrients, it can also increase leaf loss because of the extra handling needed to dry the hay. Leaves are the most valuable part of the hay since they have the highest quality. Therefore, losing leaves will decrease hay quality.

Leaf shatter, especially from legumes, can be serious at harvest time. Leaf loss can be minimized by reducing the number of times hay is handled in the field and by handling hay at high-moisture levels. Leaf loss is often 5 - 10 percent greater when hay is cut, conditioned, and raked separately than when all three operations are done at one time. Alfalfa hay that is raked and packaged very dry can yield 35 percent less dry matter and be of poorer quality than properly handled hay. Rake legume hay at a moisture content greater than 50 percent. Results of raking alfalfa hay at various moisture levels are shown in Fig. 1.

Windrower machines eliminate raking and thus the leaf loss that is caused by raking. Because drying takes longer in the windrow than in the swath, respiration losses and increased potential of rain damage may reduce this advantage in humid areas.

Condition freshly cut forage, especially legumes, to allow the plants to dry rapidly, thus reducing respiration losses and the risk of weather hazards. Dry matter and crude protein losses are greater with big-package hay making machines than with conventional balers when they are operated in dry, shatter-prone alfalfa hay. There is little difference in dry matter losses from different haymaking systems when hay moisture is optimum.

### Storage

Even the best (shed or covered) storage conditions allow

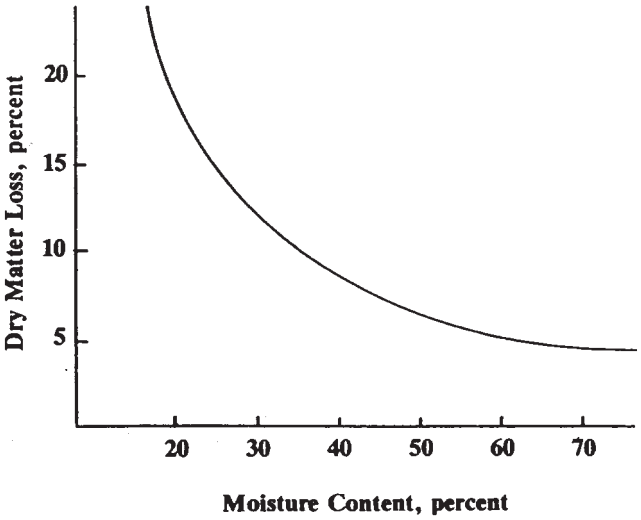


Fig. 1. Losses in Alfalfa as Influenced by Moisture Content when Raked.[1]

[1]*From Hundtolf, E. B. 1965. Cornell Univ. Ag Engineering Ext. Bull. 364. Ithaca, NY.*

about five percent of hay dry matter to be lost after one year. Most nutrients maintain nearly constant concentrations when hay is properly stored, although carotene (precursor to vitamin A) concentration declines rapidly. Losses of dry matter and quality during storage can be considerable when hay is stored too wet. These losses are caused mostly by heating, which will usually occur if hay is packaged above 20 - 22 percent moisture. Grass hay can be packaged at a slightly higher moisture content than hay containing legumes. Fig. 2 shows spoilage losses in alfalfa hay stacked at different moisture levels. Several types of hay preservatives are available that can prevent spoilage of hay packaged too wet. However, these preservatives are effective only when they are applied evenly throughout the hay at the correct rate.

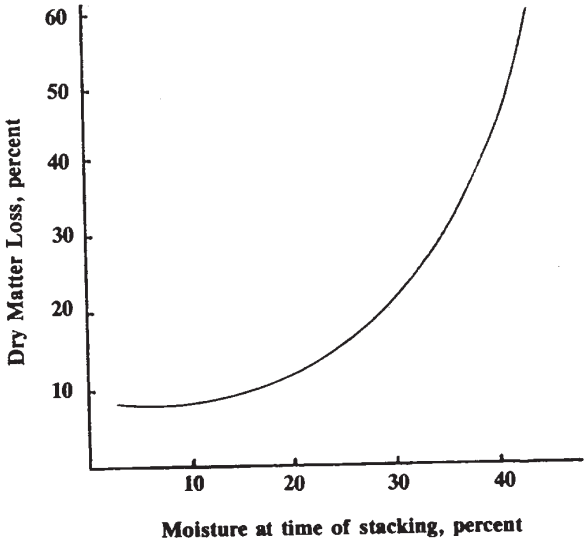


Fig. 2. Loss Due to Spoilage in Alfalfa Stacks made at Different Moisture Levels.1

[1]*From Drew, L. O. 1974. Ohio Rep. Res. Develop. 59:38.*

Hay stored outdoors is subject to losses from weathering, but amount of loss is greatly influenced by climatic variables. In wetter, more humid climates, more losses occur with hay stored outdoors than in drier climates.

Weathering occurs not only on the tops and sides of packages stored outside, but also where hay contacts moist ground. Research in Indiana has shown that storing bales on crushed rock vs. the ground reduced the weathered portion of the original bale weight from 23 - 11 percent. Thus, outdoor storage losses can be lower if good packages are made, and they are stored on a well drained site. This may not be a problem in most places in the arid West.

Weathering reduces the dry weight of hay and changes its composition. Dry matter losses during outdoor storage range from 5 - 30 percent. Losses of dry matter of loose (non-compressed) stacks usually exceed 10 - 15 percent and are greater than losses from large round bales or compressed stacks. Length of storage will also influence losses. Maintaining an inventory or carrying over a portion of the previous year's harvested hay crop is often needed to ensure against future hay shortages. However, long-term outside storage of hay may be costly.

Research in eastern Nebraska (Table 1) showed that after seven months of storage, hay in loaf stacks lost 12.4 percent of its original dry weight, 9.7 percent of the protein, and 12.1 percent of the energy (TDN). By 29 months of storage, 29.5 percent of the dry matter, 53.1 percent of the protein, and 42.1 percent of the TDN were lost. These losses can be attributed to natural processes of deterioration, including losses associated with mold and microbial activity, leaching of nutrients due to excessive moisture, and spoilage at the base of the stack.

Resistence to weather depends on how well the packages are made. In an Indiana study, from 18 - 44 percent of the hay in compressed stacks had weathered after one year of outdoor storage. The amount weathered increased to 28 - 50 percent after two years of storage. Large round bales were from 18 - 39 percent weathered after two years of storage. Tight hay packages, such as round bales, shed more water than stacks, which reduces losses during long-term storage. However, moisture content at harvesting is of greater concern with round bales than with loose stacks. Therefore, the choice of packaging may depend upon moisture content of hay, machinery operator skill, and length of time hay is expected to be stored outside.

Table 1. Percent of Initial Quantity of Dry Matter, Crude Protein and Total Digestible Nutrients (TDN) Lost from Loaf Stacks of Alfalfa Hay Stored Outside.[1]

| | Months after harvest | |
|---|---|---|
| Nutrient | 7 | 29 |
| Dry matter | 12.4 | 29.5 |
| Crude protein | 9.7 | 53.1 |
| TDN | 12.1 | 42.1 |

[1]*From Mader, T. L., J. Dahlquist, and C. Shapiro. 1990. Long-term storage effects on alfalfa losses and quality. Nebraska Beef Cattle Rep. MP-55.*

To reduce storage losses, be sure the package is dense and evenly formed, especially with compressed stacks. This allows rainfall to run off rather than settle in depressions and soak into the stack. Store packages on a well-drained site with air spaces between packages to allow drying after rain. Round bales can be butted end-to-end with little increase in loss from storage. Do not stack round bales unless they are covered with plastic.

## Feeding

Much expense and many long hours go into harvesting and storing good quality hay for winter feeding. You wouldn't dream of throwing away one-third of this hay. That is what happens when livestock are allowed unlimited access to hay, however. Livestock trample, over-consume, contaminate, and use for bedding 25 - 45 percent of the hay when it is fed with no restrictions (Table 2). Cattle will waste less hay when the amount fed is limited (Table 3). One-fourth more hay is needed when a four-day supply of hay is fed with free access than when a one-day supply is fed.

Excessive hay consumption can be a major problem when large hay packages are fed without restriction. A dry, pregnant cow may eat 20 - 30 percent more hay than she needs when allowed free access. This can amount to over 700 pounds per cow over a four-month feeding period. A 100 cow herd may overconsume 35 tons of hay if the cows have free access to hay.

**Table 2. Hay Wasted by Cows Fed with and Without Racks.[1]**

| Bale type | Percent wasted |
|---|---|
| Square bale in rack | 7 |
| Large round bale in rack | 9 |
| Large round bale without rack | 45 |

*[1]From Bell, S., and F. A. Martz. 1973. Univ. of Missouri Ag Exp. Sta. Rep.*

**Table 3. Hay Wasted by Cows on Pasture when Amount Fed was Controlled.[1]**

| Feeding system | Hay per per feeding (lb.) | Hay refused or wasted (%) | Hay required over rack feeding (%) |
|---|---|---|---|
| Rack feeding | | 5 | |
| No rack feeding | | | |
| 1-day supply | 20 | 11 | 12 |
| 2-day supply | 40 | 25 | 33 |
| 4-day supply | 80 | 31 | 45 |

*[1]From Smith, W. H. 1974. Purdue Univ. Coop Ext. Ser. ID-97.*

This is in addition to the extra hay needed to replace that wasted during free-access feeding. Hay loss and waste can be reduced by feeding hay daily according to diet needs. Compared to feeding a several day supply each time hay is provided, daily feeding will force livestock to eat hay they might otherwise refuse, overconsume, trample, or waste. Daily feeding is more efficient, especially when hay is fed free-access.

Restricting the animal's access to hay will decrease waste. Efforts that limit the amount of hay accessible to trampling will save feed. Hay racks with solid barriers at the bottom prevent hay from falling out or being pulled out by livestock and getting stepped on. Loose or compressed hay stacks should have collapsible racks or electric wire around them to reduce the amount of trampling around the edges. Feed hay on a well-drained site or on concrete when possible. Feed bunks are excellent for feeding small square bales. Round bales should be fed in specially designed racks. When feeding square bales on the ground, unrolling round bales, or using other feeding methods that place a large percentage of the hay in an easily trampled position, spread hay so that all animals have access. In addition, limit feeding to an amount that will be cleaned up within a few hours. Otherwise, cows will use the hay for bedding after meeting their immediate intake needs.

Table 4 lists the dry matter losses that occur when handling hay from field to feeding. By the time hay is fed, losses can essentially increase the amount of production needed from the original standing crop by 35 percent. Production costs can be reduced and hay making can be more profitable when the amount of hay lost and wasted during harvest, storage, and feeding is controlled.

**Table 4. Dry Matter Losses of Hay from Field to Feeding.[1]**

| | Range | Average |
|---|---|---|
| Mowing | 1-6 | 3 |
| Raking | 5-20 | 10 |
| Swathing with conditioner 1-10 | 5 | |
| Plant respiration | 2-16 | 5 |
| Baling, % of windrow | 1-15 | 5 |
| Storing, % of stack | | |
| Outside | 5-30 | 15 |
| Inside | 2-12 | 5 |
| Transporting | 1-5 | 3 |
| Feeding, % of bale or stack | | |
| With feeder | 1-10 | 5 |
| Without feeder | 2-45 | 15 |
| Total, % of original standing crop | 10-80 | 35 |

*[1]Without rain damage. Rainfall can reduce yields up to 20 percent.*

Authors:
Terry Mader, Extension Beef Specialist, University of Nebraska
Bruce Anderson, Extension Forage Specialist, University of Nebraska
Dave Sanson, Ruminant Nutrition Specialist, University of Wyoming

This publication was prepared in cooperation with the Extension Beef Cattle Resource Committee and its member states and produced in an electronic format by the University of Wisconsin-Extension, Cooperative Extension. Issued in furtherance of Cooperative Extension work, ACTS of May 8 and June 30, 1914.

**BCH-7310** Management to Minimize Hay Waste