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Section II

Alfalfa
**Chapter 18**

**Harvest**

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**Introduction**

Producing high quality hay should be the goal of every hay grower. High quality hay is a better product, is easier to market, brings a higher selling price, creates a good reputation for the seller, and encourages repeat customers by meeting consumer needs (Fig. 1). Most importantly, high quality hay brings increased profits and, as a feed, increases animal performance.

Under favorable conditions and using currently available haymaking technology, it is possible for growers to routinely produce prime alfalfa hay with relative forage quality (RFQ) greater than 151, crude protein contents greater than 19%, and digestible dry matter greater than 65%.

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**Fig. 1.** High quality hay makes for a better product, is easier to market, brings a higher selling price, creates a good reputation for the seller, and encourages repeat customers by meeting consumer needs.

Production practices used during haymaking can have a significant effect on hay yield and hay quality. Adopting the most effective and economical haymaking practices available are essential for continued improvement of production practices. All aspects of the haymaking process should be routinely scrutinized for improvement.

Fundamental to good haymaking is obtaining maximum plant mass recovery from the field and producing an economically valuable product that can be used on the farm or sold. This means efforts should be directed at keeping leaf loss to a minimum while at the same time producing a profitable crop. Alfalfa leaves dry more quickly than stems, and leaves are more likely to be damaged than stems. Growers should assess leaf loss for each haymaking practice and how they can improve their haymaking practices to increase leaf retention while at the same time producing hay that stores well and doesn’t spoil or experience other costly losses while in storage.

**The Haymaking Process**

Ideal haymaking conditions and, thus, ideal hay are not always attainable; however, having a sound understanding of the haymaking process will increase the ability of growers to manage production practices more precisely under changing conditions and therefore increase the likelihood of obtaining high quality hay more consistently. The haymaking process can be separated into four general operations: 1) Swathing and Cutting, 2) Curing, 3) Packaging, and 4) Hauling and Storing. As part of the haymaking process a few topics are relevant across all four categories. These include equipment considerations, weather, and managing harvest losses. Each of the four categories and these additional topics are discussed in this chapter.
Swathing and Cutting

Swathers are the most widely used piece of equipment for cutting alfalfa hay. Many years ago, sickle mowers were used extensively for cutting alfalfa and grass hay, but nowadays, sickle mowers are used very little for alfalfa and only occasionally for grass. There are various types of cutting devices used for hay crops. Sickles blades continue to be widely used for cutting hay crops, although disc blades are rapidly gaining in popularity.

The hay conditioner, sometimes also referred to as a “crimper,” is designed to crush and bend alfalfa in several places along the length of the stem. Various materials (e.g., rubber and steel) and designs are used to manufacture hay conditioners. Hay conditioning bends and crushes the stem which allows internal stem moisture to escape more readily. Proper conditioning speeds plant drying. Hay conditioners should be checked regularly and adjusted for optimum performance. This includes setting the proper tension on the conditioner rollers. Rollers set too tight can cause excessive leaf loss with no improvement in stem conditioning. Blister beetles are a rare problem in much of the region, but producers should keep in mind that hay conditioners on swathers will crush blister beetles, which can leaves dead beetles in the hay and this can be a potential health risk for horses.

The cutting schedule for alfalfa can be based on a fixed interval, stage of maturity, or crown shoot development. With a fixed interval, cutting is done every 28 to 33 days.

A fixed interval for cutting may be useful for planning, but it is difficult to stay on schedule when adverse weather conditions or other interferences delay harvest.

Forage yield and quality are inversely related, which means harvesting alfalfa at an immature growth state will result in reduced yields and high forage quality. Waiting to harvest at a more mature growth stage will result in high forage yield and reduced forage quality.

At least two schemes have been proposed to address the yield/quality tradeoff in alfalfa production. The first is based on the sequence fields are cut for each cutting. A field cut in the middle or end of the field sequence would be cut first in the next cutting. This approach helps ensure that some fields will be cut at immature stages and thus have high forage quality, while fields cut first during one cutting and last during the next cutting will likely have lower hay quality and a higher yield, along with increased root reserve replenishment. This scheme is applicable for production operations that have numerous fields and large acreages.

Another harvest timing scheme is based on plant growth and development of alfalfa as it is affected by each cutting during the growing season. Balancing between high forage yields and high quality can best be achieved by performing each cutting at different stages of maturity. The first cutting should be at the bud stage. Generally, the first cutting of the growing season is the largest with thick stems. At Fruita, Colorado, up to 33% of the total yield in a four-cut system can be obtained in the first cutting. Cutting early will increase quality and slightly lower the size of the cutting. The second cutting should be at midbud, and the third and fourth cuttings should be at 10 to 25% flowering. As with the first cutting, the second cutting is designed to obtain high yields and high quality. Allowing the third and fourth cuttings to flower increases root reserves and promotes increased stand persistence. Stems are smaller in the third and fourth cuttings, thus, the leaf-to-stem ratio is increased and hay quality can be high. The smaller forage yields of late summer cuttings also allows for good drying times under favorable environmental conditions.
Preferred cutting height for alfalfa is 3 to 4 inches (Fig. 2). A higher cutting height reduces yield while lower cutting heights may reduce the number of sites on the plant that produce new growth for the next cutting. For the last cutting of the growing season, a cutting height of 6 in. will increase the amount and duration of snow cover; thus, providing plants with better protection against winter injury.

The configuration of the windrow affects drying. Alfalfa in the windrow should lay evenly. “Clumpy” windrows slow drying. Alfalfa should not lay flat in the windrow. Windrows should be shaped so that they are peaked and plants are loosely intertwined. Peaked windrows permit air to circulate more readily through plant material in the windrow, which results in faster drying. Windrows should be as wide as possible and still allow for unrestricted baling. Alfalfa in wide, fluffy uniform windrows dry faster than narrow, dense uneven windrows; however, keep in mind fluffy windrows may be more susceptible to scattering by wind (Fig. 3).

The preferred time of day to cut alfalfa has been the subject of some debate. Research has shown that alfalfa cut during late afternoon or early evening contains more accumulated soluble sugars that are retained in cured hay. Ruminant animals consumed more and lactating cows produced more milk when fed PM-harvested than when fed AM-harvested hay. Yet, crude protein tended to be higher in AM-harvested alfalfa. On the other hand, alfalfa cut in the morning can experience a full day of drying compared to alfalfa cut in the afternoon. Drying alfalfa as fast as possible reduces the possibility of hay experiencing adverse weather conditions and significant yield and quality losses. Deciding which factors are most important may determine whether AM- or PM-harvested hay is preferred. Because of the time needed to harvest a large acreage of alfalfa, it may not be practical to confine harvesting to a specific time of the day. Regardless of the time of day, swathing of alfalfa and grass should not begin until dew has evaporated from plants.

**Curing**

The moisture content of alfalfa growing in the field ranges between 75 and 80%. Following cutting, the moisture content of the alfalfa must be reduced to 15 to 20% before baling can begin. Cut alfalfa must lose large quantities of water as rapidly as possible to promote good hay curing. Curing time is affected by humidity, temperature, soil
moisture, sunlight, wind speed, windrow configuration and size, weeds, and plant-related characteristics such as yield and growth stage that affects stem diameter and leafiness. Alfalfa dries most rapidly under low humidity, high temperatures, dry soil conditions, and moderate winds that do not scatter windrows.

The loss of moisture from alfalfa over a 24-hour period is not constant. The amount of moisture lost from cut alfalfa is highly dependent on environmental conditions. During the day when temperatures are high and air humidity is low and conditions are favorable, moisture loss from plant tissue can be high. At night, temperatures often decrease, air humidity increases, and conditions are not favorable for moisture loss from plant tissue causing moisture loss from plants to be low. In fact, at night it is not uncommon for plant tissue to gain some moisture back. This is evident when dew forms on swathed plants.

Sometimes alfalfa is swathed onto wet soil. Longer drying times are needed when windrows are formed on wet soils. If plants are swathed onto wet soil, the field should be monitored and once the hay in the windrow and the soil between the swaths is dry enough, windrows should be moved onto the drier soil.

The moisture content of alfalfa must be actively managed to promote fast drying while at the same time maintaining the highest quality hay possible. To promote fast curing of alfalfa and grass hay, various pieces of equipment can be used, including rakes, tedders, inverters, and fluffers.

Single side delivery rakes were used for several decades, but their use has dwindled over the years in many areas. With the advent of big balers, the use of twin, side delivery rakes has increased. This has allowed hay producers to rake two windrows together and, thus, increase the efficiency of their big balers.

Leaf loss can be high because PTO-driven side delivery rakes often twist the windrow into a “rope,” which does not promote fast drying. Because of a high operating speed and vigorous raking action, PTO-driven side delivery rakes also cause considerable leaf loss. Whatever implement is used to manipulate windrows it must be gentle on the hay to minimize leaf loss.

If plant stem moisture is too low, then dew moisture is needed to increase leaf retention during baling. If baling is performed with too much stem moisture, spoilage can occur. Baling with stem moisture is generally only warranted when humidity is expected to be so low that little or no dew will form.

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**Baling alfalfa hay with stem moisture without causing spoilage in bales can be challenging**

Generally, if alfalfa is to be baled with stem moisture, the use of an effective hay preservative is advised.

Hay moisture should be checked at the end of the drying day but before dark and before dew moisture sets in. Late afternoon or early evening is a good time to check hay moisture. In preparation for baling, monitoring hay should begin once plant moisture drops below 30 to 40%. Hay should not be baled when it is too wet. For example, on the night of Day 3 alfalfa may be too wet for baling but during the night of Day 4 alfalfa will become too dry. Growers must wait and bale when the hay is slightly dry during the night of Day 4. It is better to bale hay when it is on the dry side than it is to bale hay when it is too wet for safe storage.

**Packaging**

Baling is a critical step in good haymaking. Numerous factors that affect haymaking, particularly those related to weather conditions, are mostly beyond human con-
control; however, the baling process is subject to a high degree of management. Using good management during the baling process will increase the likelihood of achieving the highest yields and highest quality hay possible (Fig. 4).

The goal of good baling management should be to package hay at moisture contents that will achieve high leaf retention without damaging the product through loss or spoilage.

There are several methods for determining hay and stem moisture in the windrow. See the owner’s manual of your hay moisture testing meter for the manufacturer’s recommended procedure for determining hay moisture in the windrow.

Packaging hay can be accomplished in several forms and sizes. The most common method of packaging hay is baling. Small rectangular balers come in two common sizes—14 x 18, and 16 x 18-inch and tied with two- or three-tie poly twine strings or wire. Big balers, including mid-size balers—3 x 3-foot sized bales with four strings, have been quite popular in recent years. With good equipment, one or two people can bale and haul a considerable amount of hay in one day that used to take several people several days to haul. Big bales are also convenient to load onto trucks to achieve needed weight and height requirements. Big balers package hay into bale sizes of 3 x 4 and 4 x 4-foot that have 6 strings per bale and are 8 feet long.

Round balers are commonly used and are attractive to producers mainly because they are less expensive than most square balers. Round bales are typically used locally. They are not preferred for the commercial hay market. Because of their size and shape, round bales do not stack well on trucks. The weight of bales produced is an important aspect of the haymaking process. A bale that is 55 pounds or less coming directly out of a 14 x 18-inch bale chamber is considered to be light. Acceptable bales should weigh 60 to 70 pounds from a baler of this size. Bales that weigh more than 70 pounds from a 14 x 18-inch bale chamber may have moisture contents that could cause hay to spoil. Bales from a baler with a 16 x 18-inch chamber may weigh up to 80 pounds and not spoil.

Generally, hay moisture contents will be too high if the bales are so tight that the twine breaks. In actuality, hay moisture contents are often too high long before twine breaks.

Ideal hay is bright green in color, has high leaf retention (leaves remain attached to the stem), has a soft texture and flakes separate easily, shows no evidence of heat damage (discoloration, mold, or undesirable odor), and contains no foreign material.
It is difficult to make well-formed, uniform alfalfa bales from dry hay. Hay bales formed with dry hay can be lightweight, difficult to transport, and transportation losses are likely to be higher.

Growers are limited by the amount of time that hay is at the ideal moisture content for baling. Under many conditions it is not possible to bale alfalfa for extended periods and have high quality hay in all bales made during a long baling session.

As previously mentioned, moisture content in the windrow should be monitored regularly. The field should be sampled sufficiently to have a good understanding of the variability of hay moisture content across the field. The size of the bale dictates the moisture content at which hay will be suitable for baling. Hay moisture content of large balers (3 x 3, 3 x 4, 4 x 4-foot) must be lower than that for small rectangular bales. Growers who switch from small rectangular balers to big balers often have some difficulty adjusting to baling at lower hay moisture contents. The “old” hay buyer saying is, “Never buy hay from a guy the first year he owns a big baler.”

For most situations, baling small rectangular bales should not begin until no single stem is found to have a moisture greater than 16%. Once baling has started and a few well-formed (proper density, shape, and length) bales are made, the moisture content of bales should be checked. Bale moisture must be quantified by probing bales with a hand-held hay moisture probe. Each bale must be probed several times to determine the uniformity of moisture in the bale. The range of hay moisture content must be determined, paying particular attention to the high moisture content readings.

Average bale moisture should not exceed 15%. Bales should be probed equidistantly along the length of the bale in six places. Any one of the six readings on a bale should not exceed 18% for big bales, and one or more of the six readings in a small bale should not exceed 20% moisture content.

Under many climatic conditions, the amount of baling time is longer when dew is forming than when dew is evaporating. In other words, it takes longer for dew to form to a level that is too high for baling than it takes for dew already formed on the surface of the hay to evaporate and for the hay to become too dry for baling. Changes in hay moisture from evaporating dew can occur rapidly. Within a matter of minutes, hay moisture contents can drop 4 to 5 percentage points.

When balers were first invented, sisal twine (hemp) was used in making bales. Sisal twine rotted readily, would break easily during baling, and was subject to chewing by rodents, particularly mice. Transportation and storage losses were high when sisal twine was used. Fortunately, better materials have been identified for tying bales. Wire is widely used in the sheep industry because the poly twine gets into the wool. Once in the wool, there is no practical way to remove the poly twine; thus, the price of wool contaminated with poly twine is heavily docked by the buyer. Poly twine is widely used in haymaking (Fig. 5).

**Chemical Hay Conditioning**

Chemical conditioning of hay can be classified into two general types: preservatives and drying agents. Both types are intended to minimize the risk of hay experiencing weather damage (rain, wind, sun bleaching, etc.) by reducing the time from swathing to baling. Hay preservatives offer the best advantage of reducing yield losses.
and maintaining quality because hay is baled at a higher moisture content.

Drying agents are desiccants that are applied during swathing. They are intended to hasten field curing and reduce the chance for hay to experience damage from adverse weather conditions. Drying agent compounds react with the waxy layer on the surface of plant tissues, allowing water to escape more readily from inside the plant. Drying agents are usually potassium carbonate or a mixture of potassium and sodium carbonate. Effective drying agents decrease the time needed to cure hay by a third to half; however, with drying agents, hay is baled at a conventional moisture content.

Preservatives are applied at baling and are designed to permit baling and safe storage of hay at higher moisture contents than usual. Preservatives are intended to reduce harvest losses and increase hay quality by reducing leaf loss. Preservatives also lengthen baling sessions by allowing hay to be baled later into the evening and earlier in the morning when higher amounts of dew can cause higher hay moisture contents.

The moisture content of the hay must be known when using hay preservatives. Hay with variable moisture contents creates increased difficulty in achieving uniform results with hay preservatives. Hay preservatives of any kind should not be used on hay with an average bale moisture content higher than 25% and no single moisture content reading in the bale should exceed 30%.

A study with hay preservatives was conducted at Fruita, Colorado in which alfalfa hay was baled with and without hay preservatives over a range of hay moisture contents. After bales were stacked and stored for more than 90 days, bales were checked for spoilage. Data were collected from 126 bales. Bales were obtained from three cuttings – two first cuttings and one third cutting (42 bales per cutting). Mold development did not occur in alfalfa hay baled with the hay preservative (Forco Products, Flagler, Colorado) until the average bale moisture content exceeded 23%, while hay baled without a hay preservative experienced mold development at a bale moisture content of approximately 18% (Fig. 6).

Thus, the application of the hay preservative used in this study allowed for safe baling of alfalfa hay at average bale moisture contents that were 5 percentage points higher than when alfalfa was baled without a hay preservative.

Many hay preservatives have not been thoroughly tested to determine their optimum application and performance. When possible, growers should select products that have been shown to be effective under their haymaking conditions.

**Hauling and Storing**

If baling occurs when hay is too wet, reducing excess moisture from bales can be attempted by increasing bale ventilation, by
either leaving bales in the field for a few days or by making loose stacks that allow for increased air movement around and through the bales; however, attempting to reduce the content of high moisture hay is often met with varying degrees of success.

To meet buyer specifications when selling hay based on quality it is important to maintain lot identity by field and harvest.

Once bales are out of the field and in the stack, it is easy to mistakenly think concerns about further crop losses are over. Hay losses while in storage can be substantial. Hay should be adequately protected during storage. Hay, baled at the proper moisture content, can be covered directly after baling under most conditions. Hay stacks can be covered with a top layer of straw bales, covered with hay tarps, hay roofs, or stored in buildings.

Structures used for storing hay range from sheds with only a roof to those that are fully enclosed. Hay roofs vary considerably in their shapes, pitches, and materials.

Hay tarps are available in various designs, materials, and fabrics; thus, the quality of tarps can vary considerably. Good quality hay tarps made of materials that shed water and do not deteriorate rapidly should be used. Tie hay tarps securely so wind will not damage the tarp or lift the tarp and allow water to enter the stack. Tarps should overlap or fit together so water cannot enter between them.

Inexpensive hay tarps often tear easily and degrade within a short period of time due to ultraviolet light. Poor quality or poorly positioned tarps may allow water to be channelled into a section of the stack, causing considerable stack damage. Good quality hay tarps should not rip or tear, fit tight against the stack, and last for several years. Haystacks should be inspected regularly to make sure hay is adequately protected.

Fully enclosed buildings should be sufficiently ventilated or water can collect inside the building as bales continue to lose moisture. The type of storage facility that is best suited for a particular application is highly dependent on a grower’s situation. The best storage facility for an individual grower depends on several factors, including the objectives of the hay management system, local environmental conditions, and cost of the facility.

Generally, most losses occur on the top and bottom layers of the stack, although interior damage can also occur. Interior damage often results because of a leaky covering that channels water from rain or snow melt across the top and down through an interior section of the stack.

The moisture content of bales changes during storage. Uniformity of moisture within the bale, environmental conditions, and ventilation of the bale in storage affects how
bale moisture content changes. During storage, bale weight loss increases as the moisture content of bales increases when bales go into storage. The amount of moisture loss during storage is affected by the cutting, plant characteristics such as leaf-to-stem ratios, and the environmental conditions under which bales are stored.

Hay should be stored on surfaces and in locations where bottom bales remain dry and where water will not collect or flooding does not occur (Fig. 7). Preferred surfaces for stacking hay are coarse rock or river rock. This type of material promotes good drainage and helps to keep water from ponding around bottom bales. Coarse surface material also minimizes rocks from “sticking” to bales when they are moved. Top bales should be arranged on the stack to form a peak so water and snow will be readily shed from the hay tarp.

**Haymaking Equipment**

Equipment is an essential part of modern haymaking. Reliable equipment that is well suited to the task and when properly operated can improve haymaking. Many different types of equipment are available for haymaking, including mowers, swathers, inverters, tedders, rakes, fluffers, balers, bale accumulators, stackers, loaders, and haulers. A variety of after-market accessories and supplies are available for many pieces of haymaking equipment. Before making new purchases of haymaking equipment, an assessment must be conducted to determine if the new equipment purchased will be compatible with existing equipment and established haymaking procedures.

A number of specialty devices and supplies have been marketed over the years with the promise of improving various aspects of haymaking. These products are often after-market accessories that attach to a piece of haymaking equipment. Some are supplies that are routinely used during the haymaking process. Sellers of these devices and supplies make various claims regarding the performance of their products including reduced bale moisture content, reduced leaf loss, more uniform bale size, reduced friction and thus reduced wear and tear on the baler, and increased baler performance. Some of these specialty devices and supplies can be expensive. These products must add value in terms of hay yield, hay quality, or reduced equipment repair and maintenance costs, and increased grower profits. Before purchasing specialty devices or supplies, growers should seek to find information regarding independent and thorough testing of these items.

Proper adjustment of equipment during haymaking is important to achieve quality hay (Fig. 8). The operator should monitor equipment performance during the operation, be knowledgeable about each piece of equipment used in haymaking, and be prepared to adjust machinery to improve its

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**Fig. 7.** Hay should be stored on surfaces and in locations where bottom bales remain dry and where water will not collect or flooding does not occur.
performance for the conditions under which it is operating. A good maintenance and repair schedule for haymaking equipment will serve to reduce the number and extent of breakdowns. Equipment breakdowns during haymaking, which may last only a few hours, can still result in crop losses and lower product quality. Not only should operators know how each piece of equipment operates and how to adjust it for optimum performance, but the operator should be familiar with all safety aspects of the equipment and be committed to safe use of all haymaking machinery.

The cost of owning and operating haymaking equipment has a direct effect on profitability. The cost of equipment, particularly when new, is expensive and should be carefully considered prior to making any purchase. Purchasing hay equipment when it cannot be justified can put an entire farming or ranching operation in jeopardy. Conversely, using haymaking equipment that is well-suited to the operation can increase profits and improve efficiencies (Fig. 9).

Because of their particular circumstances, it may not be advisable for growers to own their equipment. Renting or contracting with custom operators may be more economically worthwhile, but keep in mind when using custom operators you are likely to be subject to their schedule more than yours.

Producers must evaluate several aspects when considering the purchase of haymaking equipment including the value of timeliness by using their own equipment to perform specific operations, machinery purchase and maintenance costs, and the quality of the work or product quality when they perform their own operation compared to what might be expected from a custom operator. The justification for purchasing various types of haymaking equipment or hiring a custom operator to do the work is complex and will vary depending on various objective and subjective considerations that often only a particular grower can answer. Nevertheless, decisions that growers make about purchasing equipment should be based on as much objective information as possible.

Weather Considerations

Unfavorable weather adversely affects harvest in several ways. Harvest can be delayed while waiting for good weather to return. Harvest delays can also be caused by unfavorable weather that extends hay curing time. Bad weather can also extend the baling period. Hay yield and hay quality can both
be reduced to varying degrees by bad weather that occurs during harvest.

Losses in hay quality and yield can be affected by several unfavorable weather conditions. Damaging rains during haymaking are always a concern. Excessive and untimely precipitation can cause a wide range of losses in terms of both hay yield and quality. When and how much precipitation occurs during curing affects how much loss will occur. Light rains just after cutting have little effect on hay yield and quality, yet several days of consistent rain that occurs when hay is ready to bale can cause large hay losses.

Winds can also cause devastating hay losses. In extreme cases, strong winds can blow windrows completely out of the field, resulting in a total crop loss from that cutting. Windrows are most susceptible to blowing when they are dry and ready for baling.

Losses can also be experienced from dew moisture. Hay that is baled with excessive dew can experience losses from spoilage. Excessive dew may also delay baling and increase the risk of exposure of hay to other unfavorable environmental conditions. When no dew develops during baling, leaf losses increase and quality losses can be significant even though yield losses may be relatively small.

Generally, operators with a large acreage of hay cannot afford to delay harvest based on anticipated, adverse weather conditions. Delays can create scheduling problems that may carry on through the rest of the growing season. However, operators with a small acreage may find it to their advantage to monitor weather forecasts and identify a favorable period of time to harvest.

Hay bales should not have surface moisture on them going into the stack. If bales get rained on, they should not be picked up in the field until they are completely dry. Similarly, bales with heavy dew on them should also not be picked up until all of the dew has evaporated off the bales.

Haymaking operations can be managed in several ways to cope with weather-related concerns. Bales should be removed from the field as soon as possible after hay is baled. Bales should not be left in the field any longer than necessary. This practice will decrease the potential of bales being exposed to adverse weather. Bales should also be stacked and covered to protect hay from exposure to adverse weather.

**Managing Harvest Losses**

Significant dry matter losses can occur from the numerous field operations used during the haymaking process (Fig. 10).

Even when losses are minimal, dry matter losses from each operation can accrue to a total that has a significant impact on yield and quality (Table 1). Haymaking losses can have a significant effect on profits (Table 2). Performing each field operation as precisely as possible will lower losses. For example, swathers should be adjusted, maintained, and operated properly to cut and form windrows. The correct ground speed will allow the swather to cut plants com
pletely. Swath manipulation should be done after the alfalfa has dried considerably but before plants become so dry that disturbing the windrow causes excessive dry matter losses. Baling to obtain the proper bale weight, density, and length can reduce crop loss during handling. Uniform, tight, and well-shaped bales are better suited for making stacks that are even and snug and, thus, the risk of broken bales and stack collapse is reduced (Fig. 11).

![Baling alfalfa](image)

**Fig. 11.** Baling to obtain the proper bale weight, density, and length can reduce crop loss during handling.

### Table 1. Possible crop losses of alfalfa during harvesting and storage.

<table>
<thead>
<tr>
<th>Field Operation</th>
<th>Crop Loss %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swather with conditioner</td>
<td>1 to 5</td>
</tr>
<tr>
<td>Flail mower</td>
<td>6 to 11</td>
</tr>
<tr>
<td>Tedding</td>
<td>1 to 3</td>
</tr>
<tr>
<td>Swath inversion</td>
<td>0 to 2</td>
</tr>
<tr>
<td>Raking</td>
<td>1 to 20</td>
</tr>
<tr>
<td>Bailing</td>
<td>2 to 5</td>
</tr>
<tr>
<td>Hauling</td>
<td>1 to 5</td>
</tr>
<tr>
<td>Storage</td>
<td>5 to 10</td>
</tr>
<tr>
<td>Average loss per cutting</td>
<td>24 to 28</td>
</tr>
</tbody>
</table>

### Table 2. Monetary losses of hay at various yield levels that occur as a result of losses during the haymaking process.

<table>
<thead>
<tr>
<th>Yield (tons/acre)</th>
<th>Loss (%)</th>
<th>Monetary loss of hay valued at $120 per ton</th>
<th>Loss (%)</th>
<th>Monetary loss of hay valued at $120 per ton</th>
</tr>
</thead>
<tbody>
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<td>7.50</td>
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<td>90</td>
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<td>180</td>
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<td>6.75</td>
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<td>5.50</td>
<td>10</td>
<td>66</td>
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<td>5.00</td>
<td>10</td>
<td>60</td>
<td>20</td>
<td>120</td>
</tr>
</tbody>
</table>

**Conclusion**

The moisture content of growing alfalfa is between 75 and 80%. Plant respiration continues until the moisture content of plant tissue drops below 40%. Once cut, alfalfa must lose large quantities of water as rapidly as possible to promote good hay curing and result in high quality hay. To help ensure high yields and high quality, harvest management practices should be used that reduce the time from cutting to baling (Fig. 12).

Performing operations in a timely manner is critical to good haymaking. Operations, done in a timely manner, do not generally increase production costs, but have a big impact on hay yields and product quality. Using good management and performing haymaking operations on a timely basis can increase profits.
New technology is continually being developed to improve haymaking. Information on the latest developments in haymaking should be sought from reputable sources. Sources of good information on haymaking include high quality trade magazines, grower meetings sponsored by respected companies and organizations, knowledgeable crop consultants and Extension personnel, and numerous internet web sites hosted by universities, government agencies, forage organizations, and companies.