# Hay Production 19

When pasture growth is scarce, it is necessary to provide some type of stored feed for grazing animals. Hay offers a number of advantages: It can largely be mechanized; it stores well when adequately protected; and it can meet the nutritional requirements of most classes of livestock.

Hay fits well with a grazing program because accumulated forage can be cut for hay during periods of excess growth, thus minimizing waste. Harvesting excess growth also results in the subsequent production of young, tender forage regrowth for later grazing.

## Hay Crop Selection

The first step in hay production is deciding what forage species to plant. This decision is obviously limited to those species adapted to the location. Other considerations should include nutritional needs of the animals consuming the hay, the relative nutritional value of hay that can be produced from various adapted species, probable hay yield, and cost of establishment and maintenance of each of the crops that could be grown. The information presented in **Table 19.1** provides a basis for comparison of some species that can be grown for hay.

It is generally more economical to produce hay from perennials than from annuals due to avoidance of annual establishment costs. This is especially true when producing hay for animals that have relatively low nutritional requirements. Growing a legume/grass mixture for hay production will generally improve hay nutritive value as compared to using grass alone.

When considering the economics of hay production, it is important to realize that a large proportion (usually 30 to 40 percent) of the expenses involved are fixed costs. These are costs that will be essentially the same regardless of other factors. This provides incentive for striving for both high yield and high nutritive value. If a livestock producer is going to expend time, energy, and money in producing hay, it is worthwhile to make it an efficient operation in which high production and high nutritive value hay are obtained.

## Producing the Forage

Perennial hayfields are normally in use for many years, and a poor start may have a negative impact for years to come. The goal should be a thick, vigorous stand of an adapted, productive forage variety. To achieve this, it is necessary to plant an adequate quantity of high quality, weed-free seed or vegetative material of an adapted variety. Recommended establishment practices as discussed in **Chapters 12** and **13** should be followed.

Yield is important in obtaining economical hay production, so it is essential to lime and fertilize hayfields according to soil test recommendations. Weeds and insects should be controlled with management and/or pesticides as appropriate.

**Table 19.1** Approximate hay yield, crude protein (CP), and total digestible nutrients (TDN) content of various hay crops.

| Type of hay crop | Annual or perennial | Usual hay yield, tons/A[1] | Approximate usual nutrient level[2] | |
|---|---|---|---|---|
| | | | CP, % | TDN, % |
| **COOL SEASON** | | | | |
| Alfalfa (early bloom) | P | 3-6 | 17-22 | 58-65 |
| Arrowleaf clover | A | 2-3 | 14-17 | 56-64 |
| Birdsfoot trefoil | P | 1-3 | 16-20 | 57-62 |
| Oats | A | 1-4 | 10-14 | 55-62 |
| Orchardgrass | P | 2-5 | 12-15 | 54-58 |
| Red clover | P | 2-4 | 14-16 | 57-62 |
| Rye | A | 1-4 | 8-12 | 54-60 |
| Annual ryegrass | A | 1-4 | 10-17 | 56-64 |
| Smooth bromegrass | P | 2-4 | 12-15 | 55-60 |
| Soybean | A | 2-3[3] | 12-16 | 54-58 |
| Tall fescue | P | 2-5 | 10-15 | 54-58 |
| **WARM SEASON** | | | | |
| Annual lespedeza | A | 1-2 | 12-16 | 52-58 |
| Bahiagrass | P | 3-5 | 8-11 | 50-54 |
| Browntop millet | A | 1-2 | 9-12 | 55-60 |
| Coastal bermudagrass (four wks) | P | 5-8 | 10-14 | 52-58 |
| Common bermudagrass | P | 2-6 | 9-11 | 50-58 |
| Dallisgrass | P | 2-4 | 8-12 | 55-60 |
| Foxtail millet | A | 2-3 | 9-12 | 55-60 |
| Johnsongrass | P | 2-5 | 10-14 | 55-58 |
| Pearl millet | A | 2-6 | 8-14 | 50-58 |
| Sericea lespedeza | P | 1-3 | 12-16 | 50-56 |
| Sudangrass | A | 2-6 | 9-12 | 55-60 |

[1]Assuming the crop is grown in an area to which it is adapted, using recommended production and harvesting practices.
[2]Dry matter basis, assuming recommended production and harvesting practices and no excessive weather damage. See **Chapter 17** for more about forage nutritive value.
[3]Higher yields are possible with new forage varieties.



Some livestock producers do not f
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The two most important criteria
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both are important, low digestible energ
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generally be on improving the digestibl
total digestible nutrients (TDN) or dige

Factors that can influence hay nu
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Nitrogen fertilization will, up to
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Periodic soil testing followed by
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| TDN, % | |
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Some livestock producers do not fully understand what they should be striving for when producing hay. On many farms, the emphasis is generally on the quantity of hay produced per acre. The most important consideration, however, is not the quantity of hay produced, but rather the quantity of available and digestible nutrients stored and the level of animal performance that will result from feeding the hay.

The two most important criteria used in evaluating hay nutritive value are the crude protein (CP) content and the energy value (see **Chapters 17** and **18**). Though both are important, low digestible energy is usually the main limiting factor in Southern livestock rations. Therefore, the emphasis with regard to nutritive value of hay should generally be on improving the digestible or available energy value usually expressed as total digestible nutrients (TDN) or digestible energy (DE).

Factors that can influence hay nutritive value include: plant species, plant variety, weeds, insect damage, diseases, weather at harvest, and harvesting techniques. However, once a hayfield has been established, hay nutritive value is most likely to be affected by two other factors, both of which are under the control of the producer: 1) fertilization and 2) stage of maturity at harvest.

Nitrogen fertilization will, up to a point, increase the protein content of grass hay. Fertilization with other nutrients such as phosphorus, potassium, magnesium, and sulfur may also influence the amounts of these elements that are present in forage as well as other nutritional factors.

Periodic soil testing followed by applying the amounts and types of nutrients recommended will allow the levels of specific nutrients in forage tissue to be adequate for animals. Fertilization may also improve hay palatability to animals and thus influence animal performance by increasing intake. Although important in obtaining good hay yields, fertilization normally has little or no influence on the energy level of hay.

The single most important producer-controlled factor influencing hay nutritive value is stage of maturity at harvest. This is where many livestock producers can most easily and dramatically improve hay feeding value.

The stage of maturity at harvest influences the palatability, CP content, and especially the digestible energy level. In general, the best time to harvest for a good yield as well as high energy and CP levels is in the bud to early bloom stage for legumes and in the boot stage (just before seedhead emergence) for grasses. Exceptions to this rule are: sericea lespedeza–15 to 18 inches; summer annual grasses–30 to 40 inches; and hybrid bermudagrass–four to five week intervals or 15 to 18 inches. Forage nutritional value deteriorates rapidly with advancing maturity, even though yield will continue to increase. Advice regarding specific times to cut various forages is provided in **Table 19.2.**

If a producer waits until past the recommended stage to cut hay, the fiber content increases, and palatability and digestibility decline. Waiting until later will increase the number of bales or tons of hay produced, but nutritive value decreases.

In addition to requiring more fuel, time, and labor to store the hay, the farther past the optimum stage that hay is harvested, the poorer animal performance will be because of low digestible energy and high fiber. Poor hay passes more slowly through

Table 19.2 Recommended stages to harvest various hay crops.[1]

| Plant species | Time of harvest |
|---|---|
| Alfalfa | Bud stage for first cutting, one-tenth bloom for second and later cuttings. For spring seedings, allow the first cutting to reach mid-bloom. |
| Orchardgrass, timothy, or tall fescue | Boot to early head stage for first cut, aftermath cuts at four to six week intervals. |
| Red, arrowleaf, or crimson clovers | Early bloom. |
| Sericea lespedeza | Height of 15 to 18 inches. |
| Oats, barley or wheat | Boot to early head stage. |
| Soybean | When pods are about half-filled and before bottom leaves begin to fall. |
| Annual lespedeza | Early bloom and before bottom leaves begin to fall. |
| White (or ladino) clover | Cut at correct stage for companion grass. |
| Hybrid bermudagrass | 15 to 18-inch height for first cutting, then every four to five weeks or when 15 inches high. |
| Birdsfoot trefoil | Bud to early bloom or at correct stage for companion grass. |
| Sudangrass, sorghum-sudan hybrids, pearl millet | Height of 30 to 40 inches. |

[1]**Adapted from:** J.D. Burns, J.K. Evans, and G.D. Lacefield, Quality Hay Production, Southern Regional Beef Cow Calf Handbook, SR 5004. (See **Appendix A.29**).

the animal digestive system, causing lower intake of poor hay, which further reduces animal performance.

Thousands of tons of hay have been harvested too late or rain damaged because of equipment problems. Before beginning the harvesting process, all hay equipment should be checked for needed repairs and serviced. This should include sharpening blades, checking belts, and lubrication.

Some hay crops require that a particular stubble height be left. For example, sudangrass, sorghum-sudan hybrids, and pearl millet should not be cut lower than 6 to 8 inches. Sericea lespedeza and orchardgrass should not be cut lower than about 4 inches.

Hay should normally be cut when the dew has dried off the forage. It is important that the mower be set to cut forage at the proper height. The travel speed of the tractor should be slow enough that all the forage is cut cleanly and evenly. Periodic adjustments in speed may be necessary due to variability in stand thickness.

Many producers use mower/conditioners or have hay conditioners (or crimpers) that are used separately from mowers. Conditioners can reduce drying time by as much as 50 percent. They are essential for legumes and thick-stemmed grasses such as pearl millet and sorghum-sudan hybrids.



Respiration refers to the breakdown process, which occurs in all living plants, c plants are cut and does not decline greatly about 40 percent. Respiration during hayn 2 to 16 percent, depending on the situatio respiration losses are minimized; when dry may be high (see **Appendices A.39** and **A.**

Rain can damage hay in several ways the moisture level high, thus prolonging th increasing the likelihood of mold.

Rain during field drying damages legu the hay when rain occurs, the greater the da concern about rain usually results in more le

By crushing plant stems, a condition more quickly to the 40 percent level at wh An additional benefit is that when hay dri damage is reduced because the hay can be

Leaf losses are often high with legum red clover. When legume hays are raked or of around 5, 10, and 20 percent are likely 20 percent, respectively. Therefore, it is ad hays fall below 40 percent moisture.

The usual moisture range for raking reduce leaf loss, hay should be raked in th be desirable to rake legume hay early in th order to minimize leaf shatter.

Raking should be done with great ca leaf loss during harvest. Windrows should amount of hay exposed to the air. Narrow, wide, thin ones. Also, hay dries more quic

Hay drying may also be speeded wit (dessicants), the active ingredient of which products are normally applied with a spray with a deflection bar in front of the boom good spray coverage. Dessicants break dow legume hay crops, principally alfalfa, and

## Baling Hay

Baling should be done in the same c should progress at a slow enough speed th into the baler. It is important to keep the constant as this aids in storage and handli

Respiration refers to the breakdown of food materials within plants. This process, which occurs in all living plants, continues at a substantial rate after forage plants are cut and does not decline greatly until the moisture content drops to below about 40 percent. Respiration during haymaking can result in dry matter losses of 2 to 16 percent, depending on the situation. When drying conditions are good, respiration losses are minimized; when drying conditions are poor, respiration losses may be high (see **Appendices A.39** and **A.42**).

Rain can damage hay in several ways. It leaches soluble nutrients and keeps the moisture level high, thus prolonging the period of high respiration loss and increasing the likelihood of mold.

Rain during field drying damages legume hay more than grass hay. Also, the drier the hay when rain occurs, the greater the damage. However, delayed harvest due to concern about rain usually results in more loss in nutritive value than does rain damage.

By crushing plant stems, a conditioner causes moisture levels to drop much more quickly to the 40 percent level at which respiration losses are greatly reduced. An additional benefit is that when hay dries more quickly, the likelihood of rain damage is reduced because the hay can be baled sooner.

Leaf losses are often high with legumes such as alfalfa, sericea lespedeza, and red clover. When legume hays are raked or tedded at low moisture levels, leaf losses of around 5, 10, and 20 percent are likely to occur at moisture levels of 50, 35, and 20 percent, respectively. Therefore, it is advisable to complete raking before legume hays fall below 40 percent moisture.

The usual moisture range for raking should be around 45 to 55 percent. To reduce leaf loss, hay should be raked in the same direction as it was mowed. It may be desirable to rake legume hay early in the morning before the dew has dried in order to minimize leaf shatter.

Raking should be done with great care because this is the greatest source of leaf loss during harvest. Windrows should not be too thick because this reduces the amount of hay exposed to the air. Narrow, thick windrows will not dry as rapidly as wide, thin ones. Also, hay dries more quickly in a swath than in a windrow.

Hay drying may also be speeded with commercial hay drying agents (dessicants), the active ingredient of which is usually potassium carbonate. Such products are normally applied with a spray boom mounted just ahead of the mower with a deflection bar in front of the boom. The bar bends the plants over and allows good spray coverage. Dessicants break down the waxy coating on the stems of certain legume hay crops, principally alfalfa, and can be of benefit on some farms.

## Baling Hay

Baling should be done in the same direction as mowing and raking. Baling should progress at a slow enough speed that the hay will be cleanly and evenly fed into the baler. It is important to keep the density, size, and shape of bales relatively constant as this aids in storage and handling.

**A skillful operator can keep baling losses low with large package hay equipment.**

Leaf losses can also be high during baling operations, ranging from 1 to 15 percent. One way to reduce leaf loss at baling is to spray an organic acid (propionic acid is most commonly used) on the hay to inhibit microorganism growth. This allows baling at moisture levels up to 30 percent rather than the 15 to 20 percent range normally required for safe storage without mold damage (safe baling moisture % for various types of bales is provided in **Appendix A.36** on page 341).

Baling losses with conventional balers (producing small rectangular bales) are typically 3 to 8 percent, while baling losses with large round balers can vary from 5 to over 15 percent. Thus, the potential baling loss is greater with large round balers, but a skillful operator may keep such losses as low or lower than would be obtained with a conventional baler.

It should be emphasized that these figures do not account for storage or feeding losses (see **Chapter 20**). Round bales stored outside may have a high spoilage loss, while hay stored inside should have virtually no storage loss. Feeding losses also tend to be much higher with round bales than with square or rectangular bales.

## Forage Testing

The best way to determine the nutrient content of hay is to have a sample analyzed at a testing facility (see **Chapter 17**). To obtain accurate results from such tests, a good representative sample must be obtained. The best means of getting a good sample for testing is with a core sampler. At least 20 cores should be taken for each sample submitted for analysis. Once the results of a test are obtained and the quality of a lot of hay is known, that information can be used in effectively formulating diets for livestock. SF





Many of the factors important i
common sense. Nonetheless,
more than a producer might
and poor feeding practices are particular
producing the hay has already been incu

## Storage

Small rectangular bales of hay sho
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be stored outside and covered with plast
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Large round bales and stack systen
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Net-wrapped bales have been sho
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**Great differences can occur in the am
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