

PRODUCING QUALITY ALFALFA HAY

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Hay is one of the most versatile of stored forages in that (1) it can be kept for long periods of time with little loss of nutrients if protected from weather; (2) a large number of crops can be successfully used for hay production; (3) it can be produced and fed in small or large amounts; (4) it can be harvested, stored and fed by hand or the production and feeding can be completely mechanized; and (5) hay can supply most nutrients needed by many classes of livestock. Hay is, therefore, the most commonly used stored feed on most farms.

Alfalfa hay is an important part of Kentucky's forage/livestock system. Alfalfa as a crop is the highest yielding, highest quality forage legume in Kentucky. It is highly versatile in that it can be used in many forms including hay, haylage, and pasture by nearly all types of livestock. Kentucky raises over 300 thousand acres of alfalfa annually and has the potential for up to 2 million acres. Alfalfa hay is the base of the Kentucky cash hay market and is a significant part of the rations of lactating dairy cows, horses, and growing beef animals.

Since alfalfa hay is such a widely used feed, it is important to understand the factors that affect quality of hay.

Factors Affecting Alfalfa Hay Quality

Several factors will impact alfalfa hay quality, including stage of maturity, variety, soil fertility, weed and insect control, curing conditions, moisture at raking and baling, and method of storage.

Stage of Maturity: Of all the factors affecting hay quality, stage of maturity when harvested is probably the most important, and the one in which greatest progress can be made. As legumes and grasses advance from the vegetative to reproductive (seed) stage, they become higher in fiber and lignin content and lower in protein content, digestibility and acceptability to livestock (Figures 1,2). The optimum stages of maturity to harvest for high quality and long stand life of alfalfa and many other hay crops are listed in Table 1.

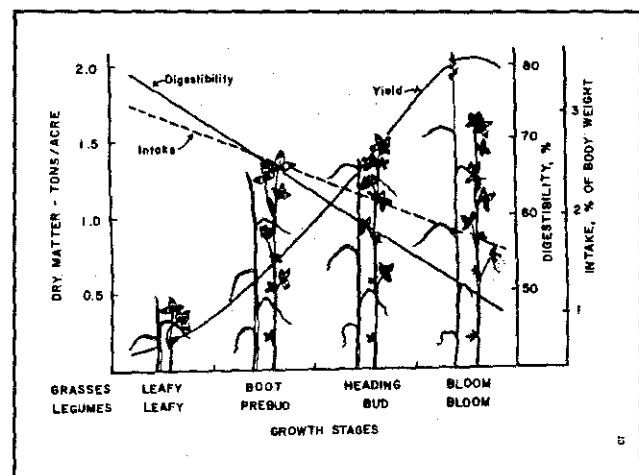


Figure 2. The effect of maturity on intake and digestibility of forage for livestock. From Blaser et al.

Making the first hay cut early permits later cuttings to be made at a time when temperature and soil moisture are more favorable for faster curing favorable for plant growth and generally increases total yield of dry matter, crude protein, and digestible energy per acre. Early cut hay resulted in high-quality feed and superior animal performance.

One great challenge of getting alfalfa hay harvested at the proper stage of maturity is the frequent rains in spring and summer and the associated poor drying conditions. The question often asked is 'Should I cut the hay and risk it getting rained on or should I wait?' Research done by Collins at the University of Kentucky

has shown that waiting is not the best course. His research looked at the effects of waiting versus rain on the quality of alfalfa hay. He concluded that cutting at the proper stage of maturity rather than waiting would result in greater hay digestibility, independent of weather.

Thinking of this in another way, it shows that it is certain that quality will decline if you delay harvest of the alfalfa, and you are not guaranteed of good weather even if you wait. As stated earlier, cutting on time will also help ensure that you are able to get you full complement of hay harvests done before September 15.

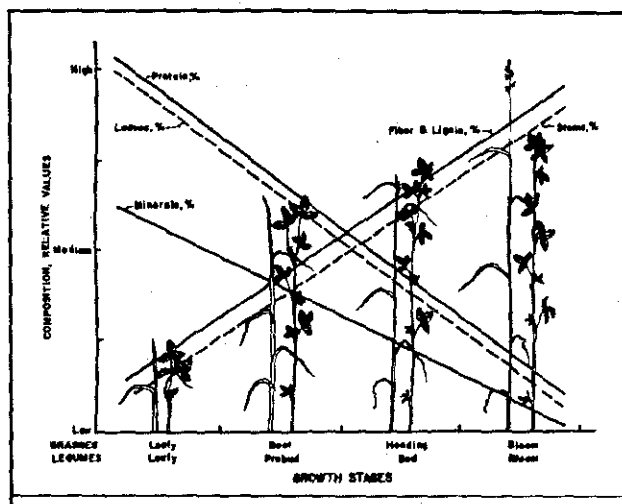


Figure 3. The effect of advancing maturity on forage quality components of plants. From Blaser et al.

Table 1. Recommended Stages to Harvest Various Forage Crops

Plant Species	Time of Harvest
Alfalfa	First flower to 1/10 bloom . For spring seedings, allow the first cutting to reach full bloom
Orchardgrass, Timothy, or Fescue	Boot to early head stage for first cut, aftermath cuts at 4 to 6 week intervals
Red Clover	Early bloom to bloom
Annual Lespedeza	Early blossom and before bottom leaves begin to fall
Oats, Barley, or Wheat	Boot to early head stage
Soybeans	Mid- to full-bloom and before bottom leaves begin to fall
Ladino or White Clover	Cut at correct stage for companion plant
Johnsongrass, Sudangrass, Sorghum Hybrids and Pearl Millet	40 inch plant height or early boot stage, whichever comes first
Bermudagrass	15 to 18 inch height for first cutting. For later cuttings, mow every four to five weeks or when 15 inches high.

Curing and handling conditions: After mowing, poor weather and handling conditions can lower hay quality. Rain can cause leaf loss and can leach nutrients from plants during curing. Rainfall shortly after mowing is less detrimental than mowing that occurs when hay is dry.

Harvest aids are available which can help to shorten drying time. First of all, keep in mind that it is the interception of solar radiation that dries hay. Therefore, it is generally better to lay the hay out in a wide swath rather than a narrow one. Second, with alfalfa, using a mower conditioner that is properly adjusted to crush and crimp the stems will aid in drying. Lastly, drying agents are marketed to be applied at the mower to speed up the drying of hay. These usually contain Potassium or Sodium Carbonate and are applied in high volumes of water per acre (20+ gallons per acre) for best results. These materials are not generally recommended and are not helpful for early and late cuttings when the air and soil are saturated with moisture. However, they will speed the drying of the middle cuttings of alfalfa.

The use of hay tedders is increasing in Kentucky among all hay growers. Tedders are designed to follow the mower and spread and fluff the swath of hay to increase radiation interception and also to increase air flow through the swath. Tedders should be used early in the curing process, when the physical action of the implement will not knock excessive amounts of leaves off the alfalfa plant.

Raking can also be detrimental to alfalfa hay quality. Ideally hay should be raked when hay is no dryer than 40 percent moisture. Again, the principle here is to minimize the leaf shatter that occurs when raking a dry windrow of alfalfa. Windrow inverters have been marketed which will, in theory, gently invert the windrow without excessive loss of leaves. However, research at UK has shown that the economic benefit of gentle inversion does not cover the cost of the implement and its' operation.

The ideal moisture content for the baling of small rectangular bales of alfalfa hay is 18 to 20 percent. Large round bales should be dryer at baling (below 18%) because of their larger size. Raking and baling hay that is too dry can lead to the loss of 34% of the dry matter, 44% of the crude protein, and 40% of the TDN of hay that is raked and baled correctly (Table 2).

Table 2. The effects of handling on alfalfa yield and quality.

	Losses				
	Raked and Baled Correctly	Raked Too Dry	Baled Too Dry	Raked and Baled Too Dry	
	lb/A	lb/A	lb/A	lb/A	Percent
Dry Hay	2900	700	100	1000	34
Crude Protein	660	210	60	290	44
TDN	1710	480	90	690	40

Source: Adapted from materials compiled by USDA-University of California.

Plant species: Legumes are normally higher in quality than grasses, but within each group can be a wide range of quality. When both grasses and legumes are harvested at the proper stage of plant growth, legumes are usually higher in total digestibility, rate of digestion, protein, and many minerals and vitamins. A mixture consisting of an adapted grass and legume is usually of high quality when properly managed.

Variety: Plant adapted, high yielding, multiple pest resistant varieties. There has been considerable interest and research into whether the multifoliate varieties of alfalfa or those that are specifically selected for quality are in fact an improvement over well managed traditional varieties. Research into this question is ongoing at UK. Preliminary results at UK and other universities indicates that there is not clear cut, consistent advantage in forage quality from selecting a multifoliate or enhanced quality variety. More information will be presented as it becomes available.

Seed quality: Seed high-quality, certified seed at recommended rates and dates for local conditions. Fall seedings should be made early enough for establishment before cold weather stops or slows growth. Late winter and early spring seedings should be made early enough to provide a vigorous stand to survive summer drought and weed competition.

Weeds: Weeds generally lower hay quality by adding material lower in palatability and digestibility. Some may be harmful or toxic. Therefore, clean seed (which is free of weed seed) is especially important when planting perennial hay crops.

Proper management practices: Topdressing annually according to hay removal and soil test will keep stands thick and high yielding. Thick stands will compete better with

weeds and will cause alfalfa to have finer stems. Also, control of alfalfa weevil and leaf hopper will result in higher yields and higher quality harvested per acre.

Evaluating Hay Quality

Forage testing: The most practical way to determine the nutrient content of hay is through chemical analysis. If hay is stored so a representative sample can be taken and submitted for analysis, results can be used to assess quality and to determine amount and type of supplementation needed for the desired level of animal production. The use of an instrument to obtain a core sample of hay has been one of the most reliable methods of getting a representative sample for chemical analysis. Determining hay quality and matching the quality to different classes of livestock based on nutrient requirements can lead to a more efficient forage-livestock program.

The ultimate test of hay quality is animal performance. Quality can be considered satisfactory when animals consuming the hay give the desired performance. Three of the factors which influence animal performance are: (1) consumption - hay must be palatable if it is to be consumed in adequate quantities; (2) digestibility and nutrient content - once the hay is eaten, it must be digested to be converted to animal products; and (3) toxic factors - high-quality hay must be free of components which are harmful to animals consuming it. Since alfalfa is a high quality crop, it is best used for feeding animals with higher nutritional needs. These animals will respond to high quality, and conversely their performance will suffer when quality declines. Steer gains on good, fair, and poor alfalfa hay ranged from 1.85 to -0.06 pounds of gain per day (Table 3).

Table 3. The effect of alfalfa hay quality on the gains of beef steers.

Quality	Alfalfa Hay Quality		
	Good	Fair	Poor
Crude Protein, %	18.7	15.9	13.7
Crude Fiber	29.4	35.4	46.7
Animal Performance			
Hay Intake, lb/day	17.1	16.5	13.8
Gain, lb/day	1.85	1.49	-0.06
* 550 lb. beef steers. Source: University of Tennessee			

Making and Storing in Big Packages

The principles of packaging are essentially the same for all methods, i.e., compressing the loose hay into a package which can be handled and stored conveniently. Just because hay is put into a large round bale does not automatically make it bad nor does it make it immune from weathering damage when stored outside. High quality alfalfa hay can be put up in large round bales. However, this hay must be protected from the weather and raised off the ground to prevent excessive losses of dry matter and quality.

Summary

Making high quality alfalfa hay in Kentucky starts with an "on-time" attitude of harvest management that results in harvesting the crop at the proper stage of maturity for the livestock to be fed. Several factors will impact alfalfa hay quality, beginning with stage of maturity at harvest, but also including variety, soil fertility, weed and insect control, curing conditions, moisture at raking and baling, and method of storage. By impacting those factors that can be changed, you can maximize your ability to put up high quality alfalfa hay. Remember that hay should be tested for quality analysis to know its nutritive value, and the ultimate indicator of hay quality is animal intake, digestibility and performance.