ALFALFA FOR DAIRY CATTLE

Donna M. Amaral-Phillips
Extension Dairy Nutritionist
University of Kentucky

Alfalfa is known as the queen of the forage crops and for good reasons. Alfalfa is an excellent forage for dairy cattle because it provides nutrients needed by dairy cows in a package which is highly digestible and cost effective. Alfalfa can be grazed directly by cattle or harvested as hay, haylage, or balage. Dairy farmers will purchase locally-grown hay if it is high quality (RFV greater than 150). When marketing cash hay one needs to understand that the quality of alfalfa greatly impacts milk production and economics of a dairy operation. This impact is felt even when as little as 5 lbs of alfalfa hay is fed per dairy cow.

Merits of Alfalfa for Dairy Cattle

Alfalfa is a forage crop which is not only high yielding, but more importantly it is an excellent source of energy, protein, fiber, and minerals for dairy cattle.

- **Excellent energy source.** High-quality alfalfa is an excellent source of energy. Energy is the hardest nutrient to provide in adequate amounts to support milk production and efficient reproduction. Thus, by feeding forages higher naturally in energy it is easier to meet the energy needs of high-producing dairy cows. In addition, alfalfa contains a highly digestible source of sugars, starches, and pectins (25-30% nonstructural carbohydrates) which the rumen bacteria can use as an energy source. Also, alfalfa contains a highly-digestible source of protein and NDF (neutral detergent fiber) which increases the amount of energy available to the cow when compared to grass forages.

- **Digestible protein source.** The protein found in alfalfa hay is highly digestible and it contains a higher proportion of ruminally undegradable (RUP) or bypass protein (25-35% RUP) than grass hays.

- **Lower and more rapidly digestible NDF.** In general, NDF (neutral detergent fiber) is slowly digested in the cow's rumen and as the amount of NDF from a forage increases, forage intake is decreased. Since the NDF content of alfalfa is lower and more digestible than NDF from grass forages, this NDF is more rapidly cleared from the rumen which stimulates intake. Any time feed intake is improved, performance is increased especially with early lactation cows. A dairy farmer's greatest profit is generated during the early lactation period. In addition, alfalfa forage provides more buffering capacity in the rumen. This, in turn, helps buffer the pH changes in the

rumen and help decrease the incidence of health problems such as ruminal acidosis.

- **Higher mineral content.** Alfalfa contains a greater concentration of calcium, phosphorus, potassium, magnesium, sulfur, iron, zinc, and selenium than grasses. The concentration of minerals is greater and more available in alfalfa forage harvested at earlier stages of maturity. From a practical and economical standpoint, minerals are relatively cheaply added to dairy cow diets as inorganic mineral sources so that amount supplied through alfalfa does not greatly enhance performance or profitability.

Measuring Quality

"Relative feed value (RFV) or acid detergent fiber (ADF) is the most important measure of forage quality because it relates to the digestibility, potential forage intake, and energy of a forage"

To determine the quality of alfalfa hay, balage or silage, the forage must be analyzed for its nutrient composition by a laboratory. The most important numbers on this forage analysis are acid detergent (ADF) and/or neutral detergent (NDF) fiber content. These numbers ultimately relate to the amount of energy available to support milk production, growth, and reproduction. The ADF content reflects the digestibility and amount of energy cattle can obtain from alfalfa. The NDF content reflects the potential intake of a forage. As the fiber content increases, the digestibility, energy content and potential forage intake decrease. These changes ultimately affect performance and profitability. Protein content is a distant second in importance to fiber content.

Relative feed value or RFV is an index which compares the quality of a tested hay to full-bloom alfalfa hay. It is calculated from the ADF and NDF content of a forage and does not reflect the protein content of the forage. For alfalfa, the higher the RFV the greater the quality of the forage. Table 1 lists the different quality standards for alfalfa hay and their corresponding nutrient composition.

Table 1. Alfalfa and alfalfa-grass mixture quality standards.

Category	Relative Feed Value	ADF (%)	NDF (%)	Crude Protein (%)
Prime	> 151	< 30	< 39	> 19
1	125-150	31-35	40-46	17-19
2	103-124	36-40	47-53	14-16

Source: Alfalfa for Dairy Animals

Alfalfa Quality = Performance = Profitability

With advancing stage of plant maturity, fiber digestibility and protein content of the alfalfa plant decreases while the amount of fiber increases. Consequently, less energy is available to the cow when she consumes more mature alfalfa. Energy is the nutrient which most often limits performance in dairy or beef cattle - not protein.

> ***"When feeding dairy cows, the quality of alfalfa fed effects milk production and profitability of the dairy operation."***

Feeding high-quality forages results in greater feed intake and, as a result, dairy cows produce more milk, and they often times can produce this milk more economically. Classical studies done at the University of Wisconsin with mid-lactation dairy cows fed alfalfa hay as the sole forage found that for each one percent increase in NDF above 40%, the amount of alfalfa hay consumed by these cows decreased by 0.5 lb and milk production decreased by 1 lb per day. Feeding additional grain with lower quality forages did not increase production to the amount seen when early-cut, higher quality forages were fed.

This decrease in milk production can be seen even when as little as 5 lbs of alfalfa hay is fed. If we compare the difference in energy supplied by 5 lbs of hay with a relative feed value (RFV) of 150 versus 115, the lower quality alfalfa hay (RFV = 115) supports 1.5 lbs less milk. At current milk prices, a dairy farmer would generate $0.20 less daily income per cow with the lower quality alfalfa hay. For a 100-cow herd, this reduction in milk production would decrease milk income by $600 per month. Put another way, profitability for this farmer would be equal if he/she spent an additional $80/ton for the higher quality alfalfa hay. With the lower quality alfalfa hay, intake is often times decreased. If we take into account a 3 lbs decrease in intake of the poorer quality hay, milk production could decrease by as much as 7 lbs of milk, especially in early lactation cows. The bottom line is that dairy farmers need to buy quality hay which has been tested for its nutrient content.

Dairy Quality Hay

High-producing dairy cows need alfalfa hay which contains after harvest a relative feeding value greater than 150. Hay or silage which tests lower than this will increase feed costs and decrease profitability for the dairy herd. Forage which tests lower can be fed to those cattle which require lower amounts of nutrients relative to the high-producing dairy cow. The box to the right lists the recommended uses for various qualities of alfalfa.

Relative Feed Value	Use for dairy cattle
Over 170	Excellent forage but needs to be fed with other forages
150 to 170	High-producing dairy cows, calves under 3 months of age
120 to 150	Lower producing dairy cows, young heifers over 4 months of age
100 to 120	Dry cows (check potassium level in diet), older heifers with corn silage

Source: Adapted from Mike Hutjens- Hoard's Dairyman

Harvesting Dairy Quality Alfalfa

Maturity at harvest is the major factor affecting the nutritive value of alfalfa. As mentioned earlier, as the plant matures from the vegetative to reproductive state, the feeding value of the plant decreases. A 1999 study conducted by the University of Illinois (southern Illinois) re-illustrates (Table 2) the concept that relative feed value decreases with increasing maturity and harvest date.

Table 2. Effect of date of harvest on relative feed value. Samples where harvested through scissor clippings in 1998.

Date Harvested	Relative Feed Value	Date Harvested	Relative Feed Value
April 16th	232	May 4th	175
April 20th	230	May 7th	156
April 23rd	205	May 11th	157
April 27th	194	Optimum date of harvest for hay with RFV of 170 was May 4th	
April 30th	187		

Source: Fischer. 1999 Illinois Dairy Report.
PEAQ Prediction of Alfalfa Quality.

This author's data also illustrate that the optimum harvest date can vary tremendously between years (Table 3). In these data collected over 5 years, the optimum date to harvest first cutting of alfalfa varied by as much as three weeks.

Table 3. Variation in optimum harvest date for first cutting over a 5-year time period.

Year	Relative Feed Value	Date Harvested
1994	168	May 6th
1995	172	April 21st
1996	172	May 2nd
1997	171	May 13th
1998	174	May 4th

Source: Fischer. 1999 Illinois Dairy Report. PEAQ Prediction of Alfalfa Quality.

These scientists also compared the relative feed value of alfalfa obtained through scissor clippings or harvested as hay (Table 4). They found that approximately 20 units of RFV difference between the standing crop and that harvested as hay. These data reconfirm that leaves are lost when hay is baled. But, more importantly, they illustrated that in order to have hay in the bale test 150 RFV, the alfalfa plant needs to be approximately 20 units higher in the field before harvest.

Table 4. Relative Feed Value of alfalfa plants harvested as hay or through scissor clipping from the standing crop.

Date	Description	Relative Feed Value
5-11-98	Standing in field	157
5-12-98	Harvested	139

Source: Fischer. 1999 Illinois Dairy Report. PEAQ Prediction of Alfalfa Quality.

The growth of the alfalfa plant must be monitored to determine when to harvest for optimum performance and in order to have the greatest cash value. The first cutting is the single most important cutting because it sets the stage for harvesting later cuttings. In addition, the first cutting represents 35 to 40% of the total yield for the season. Agronomist know that forage plants decrease in quality quicker for the first cutting compared to third or later cuttings. Undersander estimated that first cutting of alfalfa decreases by 2 to 3 units of RFV daily in comparison to only one unit decrease daily for third or later cuttings. Again, reconfirming the importance of timely harvesting of first-cutting alfalfa.

In Summary

1st Alfalfa is an excellent forage for dairy cattle. It is an excellent energy and protein source. At early stages of maturity, the NDF is highly digestible and thus is readily digested by the rumen bacteria to provide energy for the cow herself.

2nd Alfalfa quality is paramount for the dairy herd because it directly impacts milk production and profitability of the dairy operation. For high-producing cows, the relative feeding value or RFV of alfalfa should be over 150. The quality of as little as 5 lbs of alfalfa hay can directly impact performance and profitability of a dairy herd especially in early lactation cows or the profit-makers of the herd.