Alfalfa "Queen of the Forage Crops" is the most important forage legume grown in the United States. It is grown over a wide range of soil and climatic conditions. Alfalfa has the highest yield potential and the highest feeding values of all adapted perennial forage legumes. It is a versatile crop which can be used for pasture, hay, silage, green-chop, soil improvements and human consumption. As a result of this crop's many merits; especially yield, quality and versatile use, it can be used successfully in many animal feeding programs.

Successful alfalfa production requires attention to details, advanced planning and timely operations. Four general objectives should be considered:

1) attention to details prior to and during establishment that will result in a dense weedfree stand,
2) fertility and pest control during the production phase that will result in high yields,
3) timely harvest that results in high quality,
4) marketing the alfalfa through livestock or as a cash crop for profit.

Cutting Schedule

Of all the factors affecting hay quality, stage of maturity when harvested is probably the most important and the one where greatest progress can be made. As alfalfa plants advance from the vegetative to reproductive stage, they become higher in fiber and lignin, lower in protein content, digestibility and acceptability to livestock. Harvesting alfalfa hay requires a compromise between quality, yield and stand persistence. Early cut hay makes a more desirable feed because it contains more of the nutrient components associated with high quality. Hay cut in an early stage is more palatable and is consumed in larger quantities by livestock resulting in improved animal performance while reducing the amount of supplementation needed over later cut hay.

Many advances have been made through research over the years that resulted in changes in recommendations on alfalfa cutting management. Traditionally, most states in the eastern U.S. recommended cutting schedules which maximized stand persistence and hay yields. Recommendations have changed and will continue to change to reflect research results which place increased
emphasis on quality. Developments which have permitted and even necessitated this change in emphasis include: 1) new varieties with multi-pest resistance, winter hardiness, rapid regrowth and greater overall yield and persistence under more intense cutting management; 2) more awareness among producers, scientists and agribusiness personnel of the importance of quality, factors affecting quality and the value of quality components; 3) advances in rapid techniques for measuring quality and in relating values obtained to animal performance; and, 4) agronomic research resulting in improved overall management including fertility and pest control practices.

**First Harvest—Most Important**

The first harvest of the season is a critical harvest. Time of first harvest sets in place the season harvest schedule. Early first harvest permits a more intense harvest schedule and can result in both higher yields and higher quality. Timely first harvest may reduce or eliminate the need for insecticide application to control weevil and can have a positive effect on alfalfa yield and quality on the next crop by reducing certain weeds. In general, considerations should be given to getting the first harvest of an established stand in the bud stage of development. For a spring seeded stand, general recommendations would be to take the first cutting at first flower.

**Number of Cuttings**

Water availability and temperature greatly influence the productivity and survival of alfalfa and the suitability of a particular cutting schedule within a region. The total number of potential harvests can vary from 6 to 10 per season under irrigation in the southwest and deep south to only one or two harvest per season in northern latitudes.

Cutting management results of producers participating in the Pennsylvania Alfalfa Growers Program from 1984-1987 were summarized by Dr. Sid Bosworth (Table 1). Of the 170 fields, 55 were harvested 5 times per year with 93 harvested 4 times and 22 harvested 3 times. Growers harvesting five times per year made their first harvest on May 17 while growers on the three cut system showed a June 2 average first harvest date. Total season yield was 7.3, 6.5 and 4.7 tons hay equivalent per acre for the 5, 4 and 3 cut systems, respectively. Highest quality was obtained using the five cut system.
Table 1. Average of first harvest date, average cutting interval, yield and quality of three cutting systems in southeast Pennsylvania (1984-1987 Alfalfa Growers Program).

<table>
<thead>
<tr>
<th>Harvests/Year</th>
<th>5</th>
<th>4</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td>Number of fields</td>
<td>55</td>
<td>93</td>
<td>22</td>
</tr>
<tr>
<td>Date of 1st Harvest</td>
<td>17-May</td>
<td>25-May</td>
<td>2-Jun</td>
</tr>
<tr>
<td>Average Cutting Interval (days)</td>
<td>34</td>
<td>37</td>
<td>40</td>
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<tr>
<td>Growth Stage of First Harvest</td>
<td>1.7</td>
<td>2.6</td>
<td>3.0</td>
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<tr>
<td>Yield of 1st Harvest (ton h.e./acre)</td>
<td>2.2</td>
<td>2.4</td>
<td>2.2</td>
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<tr>
<td>Seasonal Yield (ton h.e./acre)</td>
<td>7.3</td>
<td>6.5</td>
<td>4.7</td>
</tr>
<tr>
<td>% Crude Protein of 1st Harvest</td>
<td>23.3</td>
<td>21.1</td>
<td>20.1</td>
</tr>
<tr>
<td>% Tot. Dig. Nutrients of 1st Harvest</td>
<td>63.4</td>
<td>60.1</td>
<td>58.8</td>
</tr>
<tr>
<td>% Acid Detergent Fiber of 1st Harvest</td>
<td>33.4</td>
<td>36.4</td>
<td>37.6</td>
</tr>
</tbody>
</table>

# Growth Stage: 1-prebud; 2-bud; 3-early bloom; 4-mid bloom; 5-full bloom

(Bosworth, S.C. 1989)

Dr. Dwayne Rohweder summarized cutting frequency results of the Wisconsin Forage Council Green Gold Program. The program involved a total of 157 fields. Entrants harvesting five cuttings per season started cutting an average of 15 days earlier than those harvesting three times and 11 days earlier than those harvesting four times. Those entrants averaging 5 cuts per season averaged 31-32 days between the first 4 cuts from May to August with a fifth cut in mid to late October. Those entrants harvesting 4 cuts per season averaged 35 days between the first 3 cuts from June to August with a fall cut in early October. Those harvesting only three cuts averaged 40 days between cuttings from June to August. Those harvesting only 2 cuts did not start until mid-June with the second cut in late July. The 5-cut system increased dry matter yields by 0.6 T/A, 1.5 T/A, and 2.6 T/A over the 4, 3, and 2 cut system, respectively. This represents an average increase of more than 3600 pounds of milk per acre. From the economic standpoint this represents a $360 per acre increase as milk or at least $150 per acre increase as hay.

Workers in Missouri [Nelson et al. 1986] showed that cutting four times annually instead of five extended the stand life by about two years. Cutting only three times was too lenient in that forage quality was decreased, yield potential was not exploited and plant persistence was not markedly better than the 4-cut treatment.

Workers at Cornell University summarized "Alfalfa Harvest Management Research in New York" dating back to the last forties: 1948-1953

Three cut systems, compared to two cuts, were shown to increase yields (+15%) and quality (combination of DDM and intake, +25%).
1955-1960

Three cut systems compared to 4 cuts, were higher yielding (+30% over 3 years) and more persistent (+200%).

1960-1975

Four cut systems, with varied dates of first cut and intervals between cuts, resulted in lower yields (-20 - 30%, average 3 years) than 3 cut systems. Quality (protein) of forage from four cut system was higher than that from 3 cut system.

1980-Present

Increase quality values above 20, 30, and 40 percent, (crude protein, ADF, and NDF, respectively) are questionable in view of possible problems from low fiber and high protein solubility, particularly in finely chopped medium moisture hay crop silage.

In New York, an early first harvest, 3 cut system results in highest yields (3+ years), best stand persistence, and high quality forage.

It is obvious that cutting alfalfa on an intensive schedule can produce high yields and superb quality and may be highly desirable in a short rotation. Stand persistence is often shortened on the most intensive cutting schedule. Minnesota workers showed a significant decline in stands during the 3rd and 4th year of the 4-cut treatment. In their studies, a 4-cut system that had a long rest period in mid-summer or in later autumn had reasonable persistence after three years of harvest. Workers in Kentucky using a 6 cut schedule produced a state record yield of 10.13 T/A in 1982. The intensive cutting schedule resulted in stand decline the following harvest year. Researchers in Tennessee showed that alfalfa stands deteriorate markedly within a growing season if the interval between cuts was less than 28 days.

Fall Harvest

Recommendations for cutting alfalfa traditionally have stated that alfalfa not be cut during the fall "critical period" which has been defined as 4 to 6 weeks before the first killing frost. Advancements in variety development, fertility programs, pest control and management strategies has resulted in a number of research studies pertaining to fall management. Sheaffer et.al. conducted a comprehensive literature review on the effects of fall cutting management and concluded that the recommendation to not cut during the fall "critical period" can be liberalized to allow greater management flexibility. The concept of a "critical period" is not always valid, particularly when a winter
dormant, disease resistant variety is used and soil fertility is high.

Conclusion

Alfalfa is the premier forage legume in the U.S. Advances in variety development, establishment, pest control, fertility and harvest and utilization management will permit greater use of alfalfa. Research has shown that with the above advancements, cutting management can be more intense than has traditionally been practiced. Research has shown that through more intense cutting management, yield and quality can be improved. Limits do exist, however; beyond which stand decline will occur.