

## ALFLAFA HAY AND SILAGE AS THE BASIS FOR DAIRY RATIONS

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Dairymen in Northern California often base their rations on a combination of alfalfa hay and silages. Of the silages, corn silage predominates in tonnage, although significant tonnages of small grain silages and winter forage blends are utilized as well. Alfalfa is also ensiled, but the acceptance in usage of this method of preservation has been limited to date. Alfalfa hay and silages have often been regarded as competing roughage sources. Though they are competitive in vying for land and for inclusion in the dairy ration, it is not a simple direct competition. Alfalfa hay and cereal silages are not interchangeable in the diet of the cow in the sense that a pound of dry matter from one can replace a pound of dry matter from the other. Ration adjustments would normally be necessary.

My focus in this article will be on major considerations that, in practice, determine the quantities of alfalfa hay and silage to be fed in a given dairy herd. (When the term "silage" is used in the remainder of this paper it will refer to corn silage and to the small cereal grain silages---oat, barley, wheat.) An understanding of these factors should aid the alfalfa producer in the marketing of his product and in dealing with some of the problems that create buyer resistance.

### The Decision Makers

It is very difficult to put into print how decisions are made in the real world. It is even more difficult when decisions are made by two or more individuals acting in concert. The decision then results from an interactive process affected by numerous factors. I would nonetheless like to describe some of the dynamics of decision-making with respect to roughage choices where both alfalfa hay and silages are available in a given locality.

It would be presumptuous of me to say that nutritionists dictate feedstuff choices. In perspective, it is more proper to say that the nutritionist is one member of the decision-making team. His input, as well as the individual preferences of the dairyman, availability of feeds, management objectives and financial considerations, lead to the decision. It is also true that options considered would be different in the case of a dairy that purchases all feedstuffs compared to a dairyman-farmer who grows roughages for his own use. Considerations on the best use of cropland become complicated by the needs of the dairy herd. Thus, selection of roughages may be dictated either by the cropping plan or by the needs of the dairy herd.

Purchases of hay and silage are also influenced by traditional financing approaches such as the annually negotiated hay loan. The tendency may be to follow past patterns rather than to react to current supply and price relationships. From my limited experience in this area I feel that most lenders are sympathetic to change if the facts appear to justify it.

Prejudices of dairymen, some founded in fact, some not, may dictate the type of feeding program employed. It is difficult to equate financial success with a single approach to feeding cows. It is not only what is fed, but how it is fed that determines results. As a consequence there are innumerable successful feeding programs in use.

## Meeting the Needs of the Dairy Cow

As indicated above, alfalfa hay and silages are competitive to each other, but that does not tell the whole story. Though both alfalfa and silages contain a wide assortment of the nutrients needed by the cow, the concentrations differ markedly. Table I illustrates the differences in the major nutrients found in alfalfa hay, corn silage and oat silage. To make the comparison meaningful, all are expressed on a moisture-free basis. It is obvious that alfalfa hay and silages are competitive in the sense that they contain similar amounts of fiber, phosphorus and energy (I.D.N.).

On the other hand, alfalfa hay provides significant protein whereas silages contribute considerably less. Thus, if lower protein corn silage is substituted for alfalfa, it normally requires addition of supplementary protein sources to avoid a protein deficiency in the ration. It therefore takes corn silage plus a protein-rich feedstuff to replace alfalfa hay. Conversely, corn silage contains more energy per unit of dry matter so as silage replaces hay it might be possible to reduce grain intake.

To carry this a step further, Table II gives a listing of the major nutrient requirements of a group of cows producing 65 pounds of milk (left-hand column). In the next two columns is given the nutrient composition of a blend of either alfalfa hay or corn silage with adequate barley grain to meet energy needs. These are all given on a moisture-free basis. The only purpose is to illustrate to what magnitude the two roughage choices conform to what is needed by the cow to maintain her body and to produce the quantity of milk involved. You will note that alfalfa/barley provides more than an adequate supply of protein, but that corn silage/barley falls short. The alfalfa and barley combination is excessive in meeting calcium needs, which can cause problems in cows, whereas the corn silage/barley blend is deficient in calcium. Neither situation is satisfactory.

Finally, the last column of Table II presents the nutrient composition of a 60/40 blend of alfalfa hay and corn silage, together with an adequate amount of barley grain and cottonseed meal to meet energy and protein needs of the cow. Note that the excess of calcium has been reduced.

From this brief illustration, it can easily be seen that a combination of alfalfa and silage is complementary in providing adequate calcium while avoiding an excess. These are just a few illustrations of the nutritional interrelationships between roughage sources.

## Positive and Negative Attributes of Alfalfa Hay

Alfalfa hay has many positive attributes that argue for its inclusion in a dairy ration. In fact, many nutritionists (the author included) recommend a minimum hay level, insisting that at least this amount should always be included. There are many reasons why we do this. One overriding consideration is that alfalfa is rich in so many nutrients required by the cow that it can serve as a "great protector", insuring the meeting of so many critical requirements. Other factors that argue for a minimum alfalfa level are:

Dry roughage stimulates	rumination (cud-chewing) and
thus production of saliva	which contains buffering
agents (bicarbonate). It	is especially important
helps to neutralize acidity	of silages fed in the ration.

A minimum amount of hay aids in avoiding insufficient dry matter intake in cattle due to excess moisture from diets heavy in silage.

An adequate supply of coarse, dry roughage prevents many of the health problems in cows that are due to excessively dense diets.

Much of the above stresses the positive side of alfalfa hay use, but there is a negative side. I would like to discuss only two of these negative factors, variation in hay quality and problems in the physical handling of hay. Variation in hay quality is recognized by dairymen and hay growers alike. Hay growers know how weather, pests, diseases and other hard-to-control problems affect quality. The dairyman, especially if he is not also a hay grower, may not be sympathetic to the growers' problems. His objective is to maintain control over nutrition of his cows so that milk production is maximized and cost minimized. Variation in roughage quality is of daily concern to him. Observation of cow reaction seems to indicate that a pit of corn silage is more uniform from end to end than is the case with different lots of hay. The explanation seems to lie in the rapidity with which silage is harvested, whereas cutting and baling of hay is conducted under a tremendous variety of conditions which affect its quality. Cattle often react rapidly to a shift in hay quality. When hay is fed separately from other feeds the effect is magnified. If we could control the reaction by some means through advance information about the quality of hay to be fed (an "early warning system", if you please) we could perhaps minimize the negative reactions and enhance the positive. Unfortunately, chemical analysis and physical appearance of the hay do not always coincide with how cows behave. We have a great deal to learn in this area.

Physical handling of hay also presents some problems. In Southern California, hay is generally fed as baled hay (that is, without further processing). In the hay and silage feeding programs of Northern California, however, a significant percentage of the hay is sliced or ground prior to being fed. There is also a trend toward what is called "complete mixed rations" where hay, silage and grain components are mixed together in a mixer truck or wagon. More dairymen would go to this type of program if the equipment would handle their mix without difficulty. Unfortunately, coarsely chopped alfalfa hay tends to resist mixing in such equipment, thus increasing horsepower requirements and equipment maintenance costs. Manufacturers are continuously working to develop new equipment to do the job, and as improved models become available I would expect an acceleration of this trend. The whole idea is to take choice away from cattle, to force them to eat a balanced mixture. A mixture of hay, silage and concentrate components does tend to mask palatability problems in hay, but it does not improve the nutritional characteristics of the hay. Furthermore, the practice of weighing into a mixer truck all commodities fed allows for more effective cost control and permits identification of problems that affect intake.

Silage alone, or a mixture of silage and hay, provides a much better base for mixing with grain components in the diet than does alfalfa hay alone. This fact gives corn silage an advantage in a highly mechanized, modern dairy.

#### Optimizing Roughage Choices

All of the above considerations---nutritional difference in roughages, individual prejudices, variation in roughage quality, physical limitations to roughage use---can be dealt with in state-of-the-art formulation systems. The problem is simply to open the channels of communication between the participants in the decision-making process. The tool that allows us to deal effectively with these problems is the computer. Ration formulation for dairy cattle and other species of animals entered the high-tech age of computers about 20 years ago. It has only been in the last ten years, however, that computer ration formulation has been commonplace. Lower costs for computers and the development and maturation of software are accelerating the frequency of use of computers for this purpose. Computer programs which utilize the technique of linear programming (LP) allow the user to submit a list of available feedstuffs together with their costs and nutritive values. Utilizing this information, the computer is instructed to provide a ration which meets the needs of a group of cows at the lowest possible cost. It is also possible to constrain the computer as to minimums and maximums for various feeds for the purpose of forcing minimum feedstuff

usage levels, to uniquely characterize individual lots of feedstuffs such as roughages, and to deal with other contingencies. Furthermore, the computer reports inform us as to how much these constraints cost us. Often this knowledge is not used to full advantage.

The available computer programs provide varying degrees of sophistication, but the flexibility of the system and the knowledge of the individual using it are perhaps more important, because the available data is subject to interpretation based on local conditions. This interpretation is needed to tell a computer how to feed cows. No program available today can take into consideration all the known facts about cattle nutrition and feeding management, and give an answer that will be totally satisfactory. Nutritionists use the computer because it is fast, mathematically precise, and aids immensely in communication of the results. With the help of the computer, numerous optional feeding programs can be explored within a few minutes, and through this means we can constantly improve the results.

In conclusion, in order for alfalfa hay to compete with silages in dairy rations, emphasis needs to be placed on the positive qualities of hay with respect to its rich supply of many nutrients needed by the cow. At the same time, alfalfa hay should be recognized for its role in complementing the deficiencies in silages. More effort needs to be expended in overcoming problems in handling of alfalfa in mechanized feeding systems so that reduction in usage for these reasons is minimized. Only then will alfalfa hay continue to compete effectively against other roughages.

Table I  
Typical Nutrient Composition of Alfalfa Hay and Selected Silages

	<u>Composition (DM Basis), %</u>		
	<u>Alfalfa Hay</u>	<u>Corn Silage</u>	<u>Oat Silage</u>
Crude Protein	20.	8.	9.
Crude Fiber	23.	24.	34.
Calcium	1.4	0.3	0.5
Phosphorus	0.3	0.2	0.3
T.D.N.	61.	66.	53.

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Table II  
Nutrient Composition of Selected Roughage and Barley Grain Blends  
Compared to Cow Requirements for Producing 65 Pounds of Milk Per Day\*

	<u>Cow Require- ment</u>	<u>Composition (DM Basis), %</u>		
		<u>Alfalfa + Barley</u>	<u>Corn Silage + Barley</u>	<u>60/40 Alfalfa/ Corn Silage + Barley</u>
Protein	15.	17.	9.	15.
Fiber	17.	17.	20.	19.
Calcium	0.55	1.	0.3	0.7
Phosphorus	0.4	0.3	0.2	0.3
T.D.N.	70.	70.	70.	70.

\*Note: See text for explanation