HAY QUALITY NEEDS OF THE DAIRYMAN

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One of the major factors in a profitable dairy is feeding a balanced ration at the lowest possible cost. Since feed constitutes 50-60% of the total operating cost it is obvious that keeping these costs down relative to the amount of milk produced is a major key to profitability. It is also important that the herd produce to its genetic potential if profits are to be maximized.

Certainly one of the best ways to maximize production with minimum cost is to feed quality hay. Cows fed quality alfalfa will consume large quantities of this forage because it is more palatable, more readily digestible and moves through the digestive system more rapidly. For the purposes of this discussion the term quality as it applies to alfalfa hay will refer to the nutritive value of the forage. A high quality hay will have: 1) high intake of potential, 2) high digestibility, and 3) high potential for productivity (milk or growth).

The high intake factor must include a concurrent consideration of high substitution for concentrates in the ration. High digestibility will divide into three subfactors: 1) the total cell wall fraction is split into potentially digestible cell walls and indigestable cell walls; digestible cell wall content must be high, 2) the fractional rate of digestion of the potentially digestible cell walls must be rapid, and 3) the depression of digestibility at high intakes must be minimal. A decrease in cell walls will 1) allow more utilization of forages in place of concentrates, 2) assure higher digestibility of total hay dry matter, and 3) lessen the digestibility depression at high dry matter intakes leading to greater feed efficiency.

The feed value, or nutrient worth, of alfalfa hay is best determined by laboratory chemical analyses. Neutral detergent fiber (NDF) is a measure of cell walls (comprised of hemicellulose, cellulose, lignin, lignified nitrogen, insoluble ash) and is quite closely related to intake potential and digestibility of alfalfa. NDF has the greatest correlation with voluntary intake which may be due to the relationship of NDF and bulk density of feedstuffs. NDF content is positively correlated with eating time and rumination thus affecting the rate of particle size reduction. Proper rumen health and function is also a factor of NDF level being associated with saliva flow, rumen fermentation patterns, milk fat test and total energy output in the form of milk. Acid detergent fiber (ADF) is made up of a higher proportion of indigestible fibrous components (cellulose, lignin, insoluble ash) and is more nearly related to alfalfa digestibility than is NDF. Both of these components of alfalfa increase with plant maturity and will decrease the feeding value of the hay as they increase. Currently there is considerable research being done that indicates these components may be more useful and accurate in formulating rations for lactating dairy cows than the current use of crude fiber levels in the hay.

As indicated above plant maturity at harvest can be a useful indicator of alfalfa quality. Fiber components, ADF and NDF, are inversely correlated with alfalfa maturity and therefore indicator of feed value. The data shown in Table 1 indicate the chemical composition of alfalfa as related to maturity.

Generally, nutrients supplied by alfalfa costs less than the same nutrients in grains (however, this is not true at the present time). Today, a high producing cow must be fed large amounts of grain to satisfy their energy requirements and it becomes exceedingly important to maintain high hay intakes to maintain fiber intake and for proper rumen function. Although it's easy enough to feed adequate protein to high producing cows,

it becomes quite difficult to feed sufficient energy and fiber unless hay intake is high. Cows in the early stages of lactation will consume approximately 3.5% of their body weight in feedstuffs. When a quality forage is fed, feed intake can be increased to 4% of body weight or higher. If we have a 1400 pound cow this .5% increase amounts to 7 lbs. If this alfalfa is 18% protein and 60% TDN it would provide enough extra nutrients to support an additional 12 lbs of milk. To put this in economic terms, for 42¢ worth of hay ($120.00/ton) we have gained $1.50 worth of milk ($12.50/cwt).

Further insight on the importance of quality in alfalfa hay can be shown by examining the results of a study done by university workers in Minnesota to determine the effect of alfalfa maturity and level of concentrate feeding on digestible dry matter intake and milk production. The results of this study using high producing, early lactation dairy cows are shown in Table 2. The data shows higher milk production at pre-bloom harvest with decreases as maturity advanced. Milk fat test dropped as the level of concentrate fed increased except for full bloom hay. Also, digestible dry matter intake (DDMI) increased as concentrate level increased within each stage of maturity (see figure 1). Thus it is apparent that intake and digestibility as related to stage of maturity-chemical composition-leaf: stem ratio-are quality determinants.

Advanced maturity is related to all factors associated with intake limiting characteristics of the ration such as: bulk density, digestibility, rumination, total chewing time and rate of passage. Physical form of the hay will also affect these characteristics and should be considered in any evaluation of alfalfa quality. Most nutritionists take physical form and amount into consideration when formulating dairy rations as the effectiveness of forage fiber in maintaining adequate chewing time and rumination, which influence energy output (milk), must be part of the quality evaluation.

The vast majority of the research that has been done on alfalfa hay quality can be summarized by the following statements. 1) It is apparent that concentrate level increases will not compensate for lower quality in alfalfa hay. 2) Milk production will decline as forage maturity increases 3) The digestible dry matter intake will increase as alfalfa quality increases.

In summary, we can see that alfalfa hay harvested at pre-bloom to very early bloom maturity stages possesses high quality. It will be readily consumed, it is highly digestible, has a high substitution value for concentrate and when harvested as hay has adequate effective fiber. Assuming good conservation of nutrients during storage, stage of maturity at harvest represents the most reliable characteristic to evaluate hay quality and the relationship of chemical composition (ADF, NDF and crude protein) to quality suggests these quality predictors can be used as a basis for evaluating alfalfa nutritive value and for pricing in the market place.

Table 1. Chemical Composition* of Alfalfa Hay with Advance in Maturity.

Stage of Maturity	Crude Protein	NDF	ADF	TDN
Pre-bloom	20+	<40	<30	63+
Early Bloom	18	44	33	61
Mid bloom	16	51	38	57
Full Bloom	14-	56	41	54-

* 100% Dry Matter Basis

Table 2. Milk Production and Composition as Influenced by Alfalfa Maturity.

Milk Characteristic	% Dry Matter	Alfalfa Maturity (Bloom) Pre	Early	MID	Full
FCM-lbs/day	20	79.6	68.0	57.2	52.1
	37	83.2	69.1	62.5	55.4
	54	87.1	77.2	66.2	64.7
	71	86.0	77.2	64.7	69.5
Milk Fat, %	20	3.7	3.3	3.5	3.6
	37	3.8	3.1	3.2	3.6
	54	3.5	3.1	3.1	3.4
	71	3.2	2.9	2.9	3.5

Figure 1. Change in digestible dry matter (DDMI) with alfalfa maturity & concentrate level.

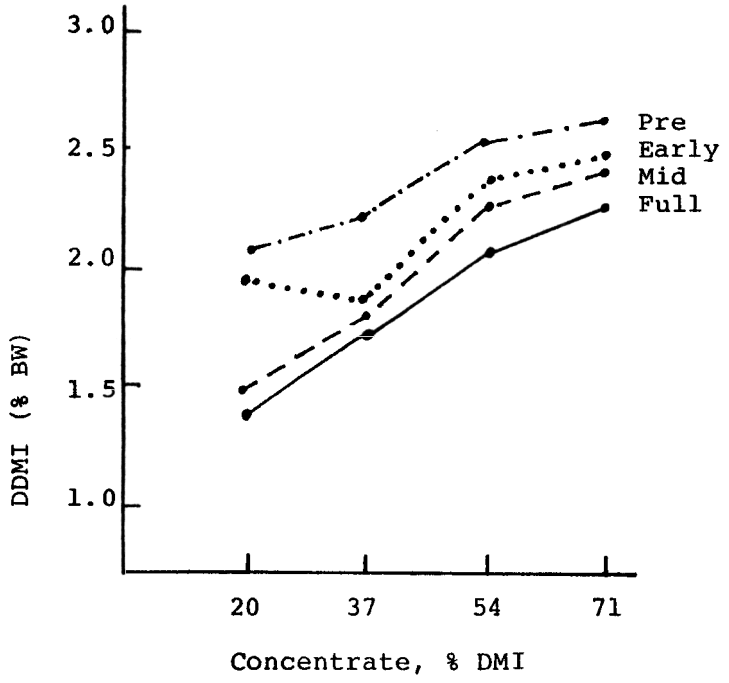

Figure 2. Change in Milk Fat Test with Alfalfa Maturity and Concentrate Level.

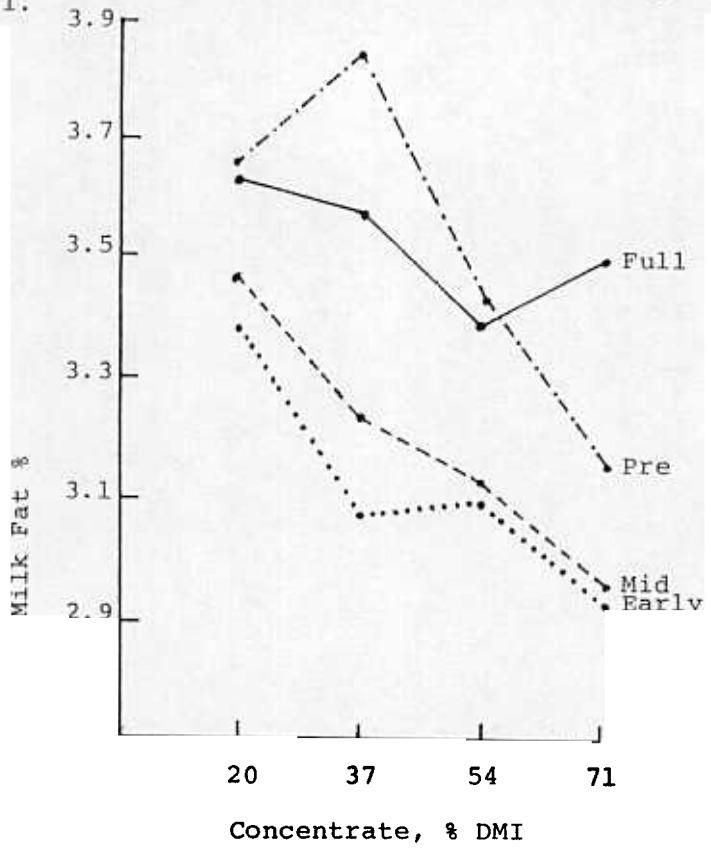

Figure 3. Change in 4% FCM Output With Alfalfa Maturity and Concentrate Level.