

# PROPOSED HAY QUALITY GUIDELINES for CALIFORNIA

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## ABSTRACT

Standards and "official" categories for different classes of alfalfa hay have been present in various forms since the 1930s. The most recent update was developed in 1985, and the designations described herein are proposed revisions of these. Standardized language for hay product categories, and updated hay quality descriptions for Low, Fair, Good, Premium, and Extra Premium categories are proposed. The primary changes from previous hay standards are the establishment of hay product categories ("Alfalfa", "Mixed Alfalfa", "Grass", "Mixed Grass", and "Rain Affected" hay), and the introduction of an "Extra Premium" quality description for Alfalfa and Mixed Alfalfa Hays. Subjective visual examination and laboratory measurement of Acid Detergent Fiber (ADF) are necessary to fully evaluate the potential feeding value of a hay lot. These descriptions define approximate categories, and communicate the importance of variation in sampling and lab measurement. These are proposed guidelines; additional comment and suggestions are solicited before publication, anticipated to be in January of 1998.

## INTRODUCTION

Over 100 million of dollars of value per year depend on the determination of the forage quality of alfalfa hay in California. The vast majority of California (and other Western states) hay is sold, primarily for the dairy industry. This is in contrast to other regions where hay is mostly used on the farm where it is produced. Most dairy hay is sampled more than once; by the grower, broker, and perhaps again by the dairy producer or nutritionist. As result, hay quality evaluation takes on great importance, and is a subject of much discussion.

## HISTORY OF CALIFORNIA STANDARDS

Hay standards were historically set by the USDA, who created the categories such as "No. 1 leafy" prior to the 1940s. These remained (with slight revisions) in effect through the 1950s and 1960s (USDA, 1958). California pioneered the use of laboratory testing for hay in the 1950s based upon Modified Crude Fiber, and shortly thereafter the University of California promoted the use of MCF in the evaluation of alfalfa forage quality. The most recent revision of the

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California standards was published in The 1985 California Alfalfa Symposium Proceedings (Lehigh, 1985), and later by Bath & Marble (1989). This system has been in general use since then, and reported in most issues of California Haymarket News (California Department of Food and Agriculture), and more recently by the USDA Market News Service. These categories were also reportedly used by Nevada, Colorado, Montana, Oregon, Utah, Washington, and Wyoming to report market sales. These designations were based upon the Acid Detergent Fiber (ADF) or Modified Crude Fiber (MCF), and Total Digestible Nutrients (TDN - which is calculated from ADF or MCF). The hay quality categories were: "Premium", "Good", "Fair", and "Low" quality hay.

Currently, hay is being traded over longer and longer distances, with a substantial portion of California's supply coming from neighboring states. In addition, hay exports to Japan and the Far East are a significant factor in Western hay markets. Therefore, measurement of forage quality is increasing in importance. Additionally, there are aspects of the hay trade (for example, lack of definition of hay product categories and questions about the current thresholds) which needed addressing. Given these circumstances, it is important to come to an agreement on the language and thresholds to be used for the trading of hay by all parties concerned.

### **THE REVISION PROCESS**

In 1996-97, a series of discussions were held for the purpose of updating the California Hay Standards. The California Farm Bureau Hay Committee discussed this at their January, 1997 meeting, and asked Mel Coelho, Former Manager of the San Joaquin Valley Hay Growers Association to form a committee to work on revision of standards. The University of California Alfalfa Workgroup discussed revisions at their February, 1997 meeting, and the California Hay Testing Consortium (a committee of hay testing labs, brokers, dairy nutritionists and hay growers) met, discussed the current and revised guidelines, and encouraged the efforts of Mel's committee charged with revising these guidelines.

In April, 1997, Mel Coelho called a meeting of dairy producers, nutritionists, hay brokers, laboratory scientists, growers, and University Cooperative Extension personnel to elicit comment, and revise these standards. Although there were some differences of opinion between buyers and sellers about exact standards, these disagreements were not major, and this document represents the best attempt at a consensus. Further discussions were held with the California Hay Testing Consortium in May and again in October, 1997. Discussions with neighboring states to judge the translation of these standards across state lines were held. The publication of these guidelines does not preclude revision at a later date, but creates a consensus of the industry at this point in time.

# CALIFORNIA HAY QUALITY DESIGNATIONS

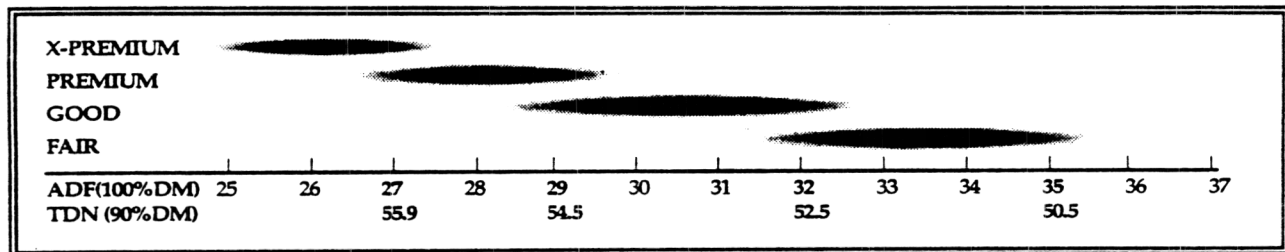
## DEFINITIONS OF HAY PRODUCT CATEGORIES:

ALFALFA HAY	- Consists of a minimum of 90% alfalfa hay.
MIXED ALFALFA HAY	- Consists of greater than 50% and less than 90% alfalfa.
GRASS HAY	- Consists of a minimum of 90% grass hay. May be designated by species.
MIXED GRASS HAY	- Consists of greater than 50% and less than 90% grass.
RAIN AFFECTED HAY	- May be any of the categories above, but must be designated as such.

## HAY QUALITY DESCRIPTIONS (FOR ALFALFA AND ALFALFA MIXED HAY):

- EXTRA PREMIUM** - vegetative, prebud or early bud, low fiber with soft stems, very high energy and protein content, very good leaf attachment, completely free of grasses and weeds, no noxious weeds, well cured. ADF <27% +/- 0.5
- PREMIUM** - Prebud, bud or early bloom, low fiber with soft stems, high energy and protein content, very good leaf attachment, mostly free of grasses and weeds, no noxious weeds, well cured. ADF value 27-29% +/- 0.5
- GOOD** - Prebloom to early-mid bloom, low to medium fiber with soft stems, fairly high energy and protein content, good color, fair leaf attachment, fairly free of grasses and weeds, no noxious weeds, well cured. ADF 29-32% +/- 0.5
- FAIR** - Early to late bloom, medium to high fiber with coarse stems, low to moderate energy and protein content, fair leaf attachment, low to moderate grass and weed content, no noxious weeds, well cured. ADF 32-35% +/- 0.5
- LOW** - Hay with a serious fault or faults. This could be due to rain damage, noxious weeds or predominance of other weeds, mold, poor curing, very high fiber (>35 ADF) very low protein content, or other serious faults. ADF >35% +/- 0.5

## ADF AND TDN RANGE FOR HAY QUALITY CATEGORIES:



QUALITY DESIGNATION	TDN (90% DM)	ADF (100% DM)
EXTRA PREMIUM	>55.9	<27
PREMIUM	54.5-55.9	27-29
GOOD	52.5-54.5	29-32
FAIR	50.5-52.5	32-35

Quality designations are approximate categories, and factors other than ADF or the factors listed here can affect true feeding value. Each category designation based upon ADF should be considered to contain a +/- 0.5% ADF variation. This indicates the minimum range of variation to be expected in sampling haystacks and laboratory analysis. TDN is based upon ADF using the recommended CA equation for western-grown alfalfa hay [TDN (100%dm) = 82.38 - (.7515 x ADF)]. Please note that most hay in California is traded on a 90% dm basis. If large differences from this DM concentration occur, parties may wish to adjust tonnage to account for moisture. However, forage quality should still be compared on %100 dm basis using ADF. These recommendations for hay quality designations were discussed by the California Farm Bureau Hay Committee, representatives of dairy producers, The California Hay Testing Consortium, and The University of California Alfalfa Workgroup

## EXPLANATION OF THE REVISED GUIDELINES

The designations currently proposed are provided in Table 1. We have termed these designations as “Guidelines”, rather than “Standards”, since there is no regulatory role. The purpose is to achieve better communication of hay quality between buyers and sellers. These revised guidelines are based upon the standards in place in California since 1985, with several modifications. The previous categories of “fair”, “good” and “premium” remain unchanged (there was a rounding discrepancy between the ADF and TDN values in some published versions, which is resolved here). The major changes are: 1. Definitions of Hay Product Categories, 2) Modification of quality guidelines to include an “Extra Premium” category, and 3) inclusion of explanatory footnotes to help in interpretation.

## DEFINITION OF HAY PRODUCT CATEGORIES

In these guidelines, hay product categories are defined (see Table 1). This is to clarify designations for “alfalfa hay” or “mixed alfalfa hay” in common usage. These designations were developed to assure buyers and sellers that the products they were describing had some mutually agreed-upon characteristics. The proportion of different species can be determined through subjective visual methods, botanical separation, or microscopy, depending upon the purpose of the evaluation.

**“Alfalfa hay”** is defined as hay containing at least 90% alfalfa on a dry weight basis. This allows a considerable quantity of weed or other material to be present before it should be designated as “Mixed Alfalfa Hay”.

**“Mixed Alfalfa Hay”** must have at least 50% alfalfa. This category could include mixtures of alfalfa with grass, clover, weeds or other mixed hay with greater than 50% alfalfa. If it falls below this level, it should be designated with the predominant species (e.g. Mixed Grass Hay, or Mixed clover hay). Alfalfa hay or mixed alfalfa hay may vary greatly in quality (from extra premium to low categories) depending upon the particular characteristics of the hay. The exception is “Extra Premium”, which contains no weeds, and so this designation is limited to “Alfalfa Hay” only.

**“Grass Hay”**, similarly to alfalfa, is defined as hay with over 90% grasses on a dry weight basis. Specific designation as to species (e.g. “Sudangrass Hay”, “Oat Hay”, or “Timothy Hay”) should also be subject to the 90% standard. For example, “Timothy Hay” should contain over 90% timothy, and if it falls below this amount (and above 50%), it should be designated “Mixed Timothy Hay”.

**“Mixed Grass Hay”** This category could include mixtures of grass with alfalfa, clover, weeds or other mixed hay with greater than 50% grass. The grass may be designated by species, but that species must range from between 50 and 90% of the composition of the hay.

**“Rain Affected Hay”** This category could include any of those listed above. “Rain affected” indicates any physical, chemical or appearance change (however slight) in the characteristics of the hay due to rain. Rain affected hay could fall into any of the Hay Quality Descriptions listed below, depending upon the extent of rain damage. If hay has been at all affected by rain, it should be designated as such.

Since grassy hays frequently enter markets for uses other than for high-producing dairy cows, hay quality descriptions (Premium, Good, Fair, etc.) may be significantly different than that for alfalfa and alfalfa mixed hay. Hence, in this publication, we have not defined Hay Quality Descriptions for Grass or mixed grass hay, but have narrowed these categories to alfalfa or mixed alfalfa hay.

### **HAY QUALITY DESCRIPTIONS (for Alfalfa and Mixed Alfalfa Hays)**

The Hay Quality Descriptions (Table 1) were developed for Alfalfa and for Mixed Alfalfa Hays which are the predominant hay types produced in California. These descriptions of hay quality categories are defined by the potential feeding value of the hay for dairy cows. Factors which may be of greater importance to other classes of livestock are not considered. Other factors, such as superficial appearance, which have little relevancy to potential feeding value are also ignored.

It should be pointed out that hay quality designations are approximate categories, with some overlap between groups. Although lab analysis plays an important role, some subjective evaluation is required. Some quality factors are best considered subjectively, by visual inspection, while other factors are best judged by lab analysis (Table 2). For example, it is difficult to subjectively judge fiber concentration by visual inspection. However, standard lab procedures will not detect the presence of weeds (toxic or other weeds), mold, or improper curing, and the hay must be examined visually. Hence, both visual inspection and lab analysis are needed for judging the potential feeding value of Alfalfa and Mixed Alfalfa Hays.

The verbal descriptions developed for these classes reflect current thinking about the importance of growth stage and quality and other factors which may predict feeding value. “Well cured” is used to designate lack of serious faults in the harvesting and curing process. These faults may include excessive bleaching, mold, excessively moist or excessively dry hay.

**Table 2.** Relative reliability of subjective visual inspection and chemical analysis for various forage quality factors for Alfalfa and Mixed Alfalfa Hays.

Quality Factor	Reliability of	
	Visual Inspection	Chemical Analysis
Stage of Maturity	Poor	Excellent
Leafiness (L:S ratio, attachment)	Fair	Excellent
Fiber Concentration	Poor	Excellent
Protein Concentration	Poor	Excellent
Foreign Material	Excellent	Poor
Texture/odor/palatability factors	Excellent	Poor

### HAY QUALITY CATEGORIES

**Extra Premium Quality Hay** is considered to have very high potential feeding value, and is defined as hay with less than 27% ADF concentration (very low fiber), high protein, and the characteristics listed in Table 1. This hay is best suited for high producing dairy cows. This hay is produced primarily in the fall and spring, rarely in summer harvests, and usually consists of less than 10% of the market. It was felt that hay products with less than 27% ADF (greater than about 56% TDN) and with very high potential feeding value should be designated as different than the hay in the 27-29% ADF (54-56% TDN) range, since hay with <27% ADF is expected to perform better than the 27-29% ADF hay. Extra premium quality hay is completely free of grasses and weeds, is soft textured and is highly palatable, and is typically harvested in the vegetative or early bud stages.

**Premium Quality Hay** is slightly higher in fiber than Extra Premium hay, but still of excellent feeding value and suitable for most high-producing dairy cows. ADF ranges from 27-29% (TDN 54.5-55.9). Since some weeds are of excellent feeding value, a small quantity of weeds are allowed in this category, provided they are low in fiber and high in protein concentration. However, no noxious weeds or weeds with anti-nutritional factors or poor palatability are permitted. Most hays in this category are prebud, bud, or early bloom hays.

**Good Quality Hay** is considered to be low to medium in fiber concentration (ADF 29-

32%), with fair leaf attachment and mostly free of grasses and weeds. This hay is suitable for medium to high-producing dairy cows, young stock, or dry cows. Good hay contains no noxious weeds and has soft stems, and is typically cut in early to mid-bloom.

**Fair Quality Hay** is typically coarse-stemmed and high in fiber (32-35% ADF), and low in protein concentration. It typically has low to moderate weed content and often poor leaf attachment. This hay can be considered for low-producing dairy cows, dry cows, or young stock. It is typically cut in the early-late bloom stage of maturity.

**Low Quality Hay** is defined as hay with serious faults. These faults could be due to very high fiber content (ADF >35), OR other faults due to excessive rain damage, noxious weeds, predominance of low-quality weed species, very low protein content, mold, poor curing, excessive foreign material, or other faults. This hay is typically not suitable for lactating dairy cows.

In most California markets, hay with greater than about 32 ADF is not often sold on a quality basis, and is often not often tested for its fiber and protein values. Other considerations, such as its marketability for the horse or beef markets take precedence. In this case, considerations such as color, condition, appearance, and percentage weeds take precedence.

## **LAB ANALYSIS & THE IMPORTANCE OF VARIATION**

**Quality measurements.** Acid Detergent Fiber (ADF) was chosen as the forage quality measurement for these guidelines. ADF is used to calculate the Total Digestible Nutrients (TDN) value which is commonly used in California. California uses a single prediction equation (see Table 1), but other equations exist. By selecting ADF (at 100% DM), we eliminate confusion about which TDN equation should be used. TDN can be easily calculated for each quality group, if needed. ADF is easily translatable across states and internationally whereas TDN is not. The 1985 standards were also based upon ADF, and so this does not represent a significant change.

The choice of ADF as the predictor of forage quality does not minimize the value of measuring Neutral Detergent Fiber (NDF) and Crude Protein (CP) or other lab measurements used to assess forage quality. These parameters may provide important nutritional information, and in the future may be included in these hay guidelines. However, at this point in time, ADF is exclusively used. For the purposes of identifying high quality alfalfa hay for purchase, ADF may be sufficient, especially when comparing pure alfalfa hays. Measurements needed for ration balancing may be different from those used in the marketing of hay products.

**Understanding Hay Test Variation.** In these guidelines, a “range of variation” is associated with each ADF value (see footnote and graphic, Table 1). The purpose of this is to remind users that the whole process of hay testing is subject to many sources of variation. The most important of these is sampling variation. There is usually far greater variation within hay lots than one might expect, therefore, a minimum of 20 cores per hay lot is recommended using appropriate hay probes and methods (Bath & Marble, 1989). Additionally, there is some variation in laboratory method, after the sample is sent to a lab, and some differences between laboratories in average performance. We consider these sources of variation to be a minimum of about +/- 0.5% ADF. In practice, this variation is often greater (closer to +/- 1% ADF).

Hence, each reported lab value should be considered to have a “range of variation” of a minimum of ½ percentage point. Therefore, under these revised guidelines, hay which tests very close to the division between two categories, may have characteristics of both categories, and may be termed as such. For example, a hay with an ADF value of 28.9 falls into the Premium category. However, a separate test may reasonably return a value of 29.1, which would place it into the “Good” category. This is well within a reasonable expectation of the range of variation in the hay testing procedures. Although undoubtedly these cases become issues for contention between buyers and sellers, we suggest that these “borderline” cases be termed “premium-good” or “good-premium” similar nomenclature to indicated their position between two categories of hay.

Hay quality guidelines, whether determined through laboratory testing or visual inspection are approximate categories for hay quality, and may have considerable overlap. In reality, there are many gradations of hay from Low Quality to Extra Premium Hay. Predicting hay quality is not an exact science. Experienced nutritionists and hay people can readily interpret ADF, NDF or CP numbers directly, and understand these sources of variation. However, purchase of hay over long distances has become more common lately, and these guidelines may become more important with increased internet or phone purchases. Communication of the existence of variation in hay testing is an important aspect of the development of these hay quality guidelines.

**Hay quality designations are Independent of Price.** The purposes of these revisions is to ensure that the language used in the trading of hay is standardized. These guidelines are based upon current knowledge about biological relationships between hay characteristics and dairy cow productivity. These proposed guidelines are independent of price considerations, which are a function of supply and demand for each category.

## REFERENCES

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