

THE "CALIFORNIA RECOGNIZED" PROGRAM AND CALIFORNIA HAY GUIDELINES

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ABSTRACT

The California Hay Testing Consortium is a volunteer committee of hay growers, analytical laboratory representatives, dairy nutritionists, hay brokers and University scientists formed to address many issues related to hay testing. This committee has made several recommendations that will affect how alfalfa hay is analyzed and marketed in California.

New hay standards have been adopted to make provision for superior quality alfalfa hays, to define alfalfa/grass mixed hay, and to emphasize the inherent variability in laboratory testing. Standardized lab procedures and reporting methods are recommended. These guidelines utilize ADF at 100% dry matter basis, rather than TDN (which is calculated directly from ADF) for marketing hay in California. The "California Recognized" program is now in place to recognize laboratories that have demonstrated proficiency in analyzing alfalfa hay for ADF, NDF and crude protein. Seven labs were recognized in 1998.

Key Words: alfalfa, hay marketing, hay testing, hay quality, ADF, TDN

THE "CALIFORNIA RECOGNIZED" LABORATORY PROFICIENCY PROGRAM

Variability in Hay Tests

Alfalfa hay with high feed value is critical to obtain the best milk production for the majority of high producing dairy herds in California. High quality alfalfa hay in California is usually sold on the basis of its feed value as determined by chemical analysis for ADF (acid detergent fiber), which predicts TDN (total digestible nutrients). The test results, along with other factors such as color, molds, or weeds, determine the value of the hay. Considerable conflict can occur when samples of the same lot sent to different analytical laboratories are returned with different results. This is especially true in years when there is a dearth of test hay.

When test results from the same lot differ, it must first be assured that each lab received the same sample. If proper sampling technique was not used when obtaining each of the samples, it cannot be expected that results will be comparable. Even if proper sampling technique is used, some variation in the results is normal. Remember that a 1-2 pound sample is representing as much as 200 tons. The only correct way to compare results from different labs is to send each lab samples split after grinding. Most laboratories will return ground samples after analysis if requested.

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Fiber analyses (ADF and NDF) are different than many other kinds of analyses in that these tests do not analyze the quantity of a distinct chemical entity, such as percent potassium in a tissue sample. Rather, ADF and NDF are defined by the method used to measure it. Acid Detergent Fiber is the amount of fiber remaining after boiling in an acid detergent solution for a specific amount of time. In order to obtain accurate results, the method used to measure the ADF or NDF must be followed exactly. Small variations in technique by a lab can introduce a bias that will change the results of the analysis.

The National Forage Testing Association (NFTA) Split Sample Program

To help laboratories check how well they are performing fiber analysis, a split sample program is conducted annually by the National Forage Testing Association. Over 150 laboratories participate in the program. Over the course of a year, participating labs receive a total of 6 samples: 4 alfalfa hay, 1 corn silage and 1 small grain hay. The samples are analyzed for ADF, NDF, crude protein (CP) and dry matter (DM) using the same procedures normally used by that laboratory for that analysis. Laboratories are asked to run the sample three times. The laboratories are graded based on statistical procedure which combines their accuracy (within lab variation) and bias (between lab variation) in a single score, their bias total accuracy.

The “true” value of each analysis is determined by taking the values reported by only those labs which had performed the analysis by strictly adhering to the official AOAC reference method, discarding outliers, and averaging the remaining values. This is called the reference method average, or RMA. Laboratories participating in the program are not required to use the AOAC reference method so long as the alternative method produces results comparable to the reference method. However, only results from those labs using the reference method are used in calculating the RMA.

Laboratories are graded based on how far their results (bias total accuracy) deviate from the reference method average (RMA). This is done by comparing their results with the variation expected when a RMA of a given magnitude is obtained, using a measure called the Horowitz standard deviation (HSD). This unit is named for a FDA scientist who looked at a large number of split sample studies analyzing many types of feeds, fertilizers, pharmaceuticals, foods, etc. and found that there was a strong correlation between the average value obtained by labs using good technique and the expected variability. From this he developed an equation that predicts the normal variation to be expected based on the magnitude of the reference method average value. For example, an RMA of 30.0 would have an expected Horowitz standard deviation of 0.36 while an RMA of 20.0 would have an HSD of 0.26. In order to pass the NFTA certification, a lab’s variation from the RMA must not exceed 4 times the HSD for the sample RMA.

The laboratories receive the results of the previous sample before receiving the next sample so they can make any necessary changes in their procedure prior to submitting the results of subsequent samples. Poor scores early may be averaged with better scores later to achieve a passing score.

The "California Recognized" Program

In the past, there has been a disincentive for many California labs to participate in the NFTA forage testing program because, in order to obtain certification, passing scores on all four analysis (ADF, NDF, CP and DM) must be achieved for all hay samples, including cereal hay and corn silage. However, some California labs rarely run NDF and/or CP, and they may not be comfortable running analysis on cereal hay or corn silage. These labs often choose not to participate in the NFTA split sample program because there is little hope of achieving certification.

To encourage all California labs to participate in a quality control program, in 1997 the California Hay Testing Consortium (CHTC) instituted a program to recognize the proficiency of labs performing laboratory analysis of alfalfa hay. Labs wishing to be "California Recognized" are required to participate in the NFTA split sample program. They then submit the results of only the four alfalfa hay samples to a designated California "judge" who reviews the scores and awards recognition of proficiency to labs who qualify according to California standards for the individual analyses. There is a fee to participate in the NFTA split sample program, however, there is no additional fee for the "California Recognized" program. The identities and scores of laboratories submitted for "California Recognition" are kept confidential; those who do not meet the qualifications are not reported, so there is no penalty for failure.

Laboratories may submit results for recognition of any of the following analyses

- Acid Detergent Fiber analysis of alfalfa hay
- Neutral Detergent Fiber analysis of alfalfa hay
- Crude Protein analysis of alfalfa hay

Separate recognition is given for NIR and wet chemistry methods.

To attain California Recognition, a lab's average "among-sample bias total accuracy" for the four alfalfa hay samples must fall within +/- 2.25 times HSD of the RMA. This is a stricter threshold than is required by the NFTA but is in line with the expectations of the California marketplace for alfalfa hay. For a 28.3% ADF (55 TDN) the allowable variation would be (2.25 x .34 HSD) or +/- .77%.

In 1998, the first year of the program, the following laboratories achieved California Recognition:

- A&L Labs, Modesto (ADF, NDF, CP of alfalfa hay) Chemistry
- Basin Agriserve, Merrill, OR (ADF of alfalfa hay) Chemistry
- CPM Labs, Merced (ADF, NDF, CP of alfalfa hay) Chemistry
- JL Labs, Modesto (ADF, NDF, CP of alfalfa hay) Chemistry
- JL Labs, Modesto (ADF, NDF, CP of alfalfa hay) NIR
- OH Kruz, Ontario (ADF, NDF, CP of alfalfa hay) Chemistry
- Mid State Labs, Visalia (ADF, NDF, CP of alfalfa hay) Chemistry
- Petaluma Hay Analysis, Petaluma (ADF of alfalfa hay) Chemistry

It is commonly expected that the test sample, when it arrives, will be analyzed with special care by the most highly qualified technician in the laboratory, and thus it represents that lab's "best" work. Whether or not routine samples run through the lab will meet the criteria is not guaranteed. However, choosing a lab that obtains "California Recognition" assures the customer that the laboratory is capable of doing quality work.

CHANGES IN THE CALIFORNIA HAY MARKETING GUIDELINES

As the needs of the marketplace have changed, hay standards need to change with them. In 1995 the California Hay Testing Consortium was convened to address hay testing issues which were resulting in conflicts between buyers and sellers of alfalfa hay. The CHTC is a volunteer committee comprised of hay growers, analytical laboratory representatives, dairy nutritionists, hay brokers, University scientists and others interested in the analysis and marketing of California hay. This group determined that the hay standards that had been in place since at least 1985 were in need of updating to better reflect the realities of the current market. The CHTC agreed on several modifications to the hay standards. The new hay guidelines were unanimously accepted by the Farm Bureau hay committee in January, 1998.

The purpose of hay quality guidelines are to help promote a common language for trading hay, and the aid in the understanding of forage quality. These guidelines should have no effect on price, which is a function of supply and demand. These are guidelines, not standards, and have no regulatory power.

Definitions of Alfalfa Hay

Hay product categories are designated to assure buyers and sellers that hay products have some mutually agreed-upon characteristics. In response to complaints in the marketplace that hay with only minor amounts of alfalfa was being advertised and marketed as "alfalfa hay", the CHTC defined hay product categories. The proportion of different plant 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 plant material to be present before it is designated as something other than alfalfa hay.

MIXED ALFALFA HAY must have at least 50% alfalfa on a dry weight basis. This category could include mixtures of alfalfa with grass, clover, weeds or other mixed forages. Hay containing less than 50% alfalfa should be designated with the predominant species (e.g. Mixed Grass Hay).

GRASS HAY is defined as hay with over 90% grass on a dry weight basis. Specific designation as to species (e.g. Sudangrass Hay, or Timothy Hay) should also be subject to the 90% standard.

MIXED GRASS HAY includes mixtures of grass with alfalfa, clover, weeds or other mixed plant species but contains 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 can include any of the categories described above. The 'Rain Affected' designation indicates any physical, chemical or appearance change (however slight) in the characteristics of the hay due to rain.

Reporting of Laboratory Analysis

In California, dairy hay has generally been marketed on the basis of its TDN (total digestible nutrient) content on a 90% dry matter basis. TDN is calculated value based on the ADF (acid detergent fiber) analysis. Across the U.S., there are at least six different equations used to calculate TDN from ADF, each yielding different TDN values from the same ADF analysis. This has been the source of some confusion, because alfalfa hay often comes from (and goes to) areas outside of California. To alleviate this situation, the new hay guidelines are based on ADF at 100% Dry Matter. This eliminates the need for any equation, and makes comparisons of hay analyses straightforward in all parts of the country.

Under the new guidelines, a 55% TDN hay at 90% DM would be reported as a 28.3% ADF hay at 100% DM. However, because of the variability inherent in both sampling and laboratory analysis, a minimum variation of +/- .5% ADF is expected, and a 28.3% ADF could in actuality be anywhere from 26.5% to 27.5% ADF (56.2% to 55.5% TDN at 90% DM). In practice this variation is often much higher.

To emphasize this normal variation, some overlap exists between hay quality categories as described in the new guidelines. It is expected that if a particular lot of hay falls in the "gray area" between two classes, that other quality factors, such as weeds, color, leafiness, etc. will be factored into the market value. In any case certain quality factors are best considered by visual inspection, while other factors are best judged by lab analysis. For example, it is difficult to assess the fiber concentration of hay by visual inspection, whereas lab analysis does not easily detect the presence of toxic weeds. Hence, both visual inspection and laboratory analysis are needed for estimating the potential feeding value or forage quality of hay.

Hay Quality Categories

To accommodate hays testing better than 27 +/- .5 ADF or 55.9 TDN, an additional category, "Extra Premium" or "Supreme", has been added. This class of hay has existed in the trade for some time; the new guidelines will allow these hays to be tracked and documented. Since the categories based on chemical analysis are mainly designed to facilitate trading of hay for the dairy market, the "Low" quality designation has been dropped from the hay quality categories because rarely does anyone test the lowest quality hays. The "Low" designation still exists as a hay description to accommodate marketing these hays for horse or beef feed, but other considerations such as color, condition, appearance, and percentage weeds take precedence.

These guidelines for alfalfa hay quality categories do not pertain to grass or mixed grass hay. Other factors, such as superficial appearance, are also ignored.

EXTRA PREMIUM OR SUPREME quality hay is expected to have very high potential feeding value compared with other classes. Extra Premium hay contains less than 27% ADF (100% dm basis) and is high in crude protein. This hay is completely free of grasses and weeds, is soft textured and highly palatable, and is typically harvested in the vegetative to early bud stages of maturity. This hay is best suited for high producing dairy cows. Extra Premium hay is produced primarily in the fall and spring, rarely in summer harvests, and typically constitutes less than 10% of the California hay market. Only 'alfalfa hay' (>90% alfalfa) can be designated 'Extra Premium'.

PREMIUM quality hay is slightly higher in fiber content than Extra Premium hay, but this hay is still of excellent feeding value and suitable for most high-producing dairy cows. The ADF content ranges from 27-29% (100% dm basis). Since some grasses and weeds are of excellent feeding value, weeds are allowed in this category, provided they are low in fiber and high in crude protein concentration. However, noxious weeds and weeds with anti-nutritional factors or poor palatability are not permitted in this class. 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%, 100% dm basis), with fair leaf attachment and mostly free of grasses and weeds. This hay is suitable for medium to high-producing dairy cows, young stock, and dry cows. Good quality hay contains no noxious weeds, has soft stems, is well cured, and is typically cut in early to mid-bloom stage of maturity.

FAIR quality hay is composed of coarse-stemmed forage which is high in fiber (32-35% ADF, 100% dm basis), and is low in crude protein concentration. It typically has low to moderate weed content and often has poor leaf attachment. This hay contains no noxious weeds, is well cured, and can be considered for low-producing dairy cows, dry cows, or young stock. It is typically cut in the early to late bloom stage of maturity.

LOW Quality Hay is hay with serious faults. These faults could include a very high fiber content (ADF >35, 100% dm basis), or other faults due to excessive rain damage, noxious weeds, predominance of low-quality weed species, low crude protein content, mold, poor curing, excessive foreign material, or other defects which reduce forage quality. This hay is typically not suitable for lactating dairy cows.

FUTURE CHANGES IN HAY MARKETING GUIDELINES

Hay marketing guidelines are constantly evolving as the needs of the hay market change and as new research provides improved analytical techniques. Many experts believe that NDF is a better overall predictor of fiber quality than is ADF. However, the analysis for ADF has been more consistently repeatable from lab to lab than NDF with less variation. Also, there has not been an official method approved by the Association of Official Analytical Chemists (AOAC). New

developments are changing both of these disadvantages, and it is possible that NDF will replace ADF as the analytical method of choice to predict feed quality when marketing alfalfa hay.

In the future, there may be more emphasis on NDF than ADF as the basis for chemical determination of hay quality. NDF appears to be a better predictor of fiber digestibility and feed intake (the amount of forage an animal will consume). While ADF is a good predictor of feed quality for alfalfa, it is less well correlated with digestibility of other forages, such as corn silage and cereal hay than is NDF. Use of NDF would facilitate cross comparisons of different forages. Currently, NDF is not used as basis for marketing hay because 1) an AOAC official method for the analysis has not been established and 2) the inherent variability in the analysis appears to be greater than with ADF. Both of these issues are currently being resolved, and NDF will then be seriously considered as a marketing tool for hay.

NDF is currently being used in other parts of the country as a major component of relative feed value (RFV). RFV is calculated using both ADF and NDF. However, for California hays, RFV adds little new information beyond that supplied by the NDF value alone, while adding the inherent variability of both ADF and NDF.

CALIFORNIA HAY QUALITY DESIGNATIONS

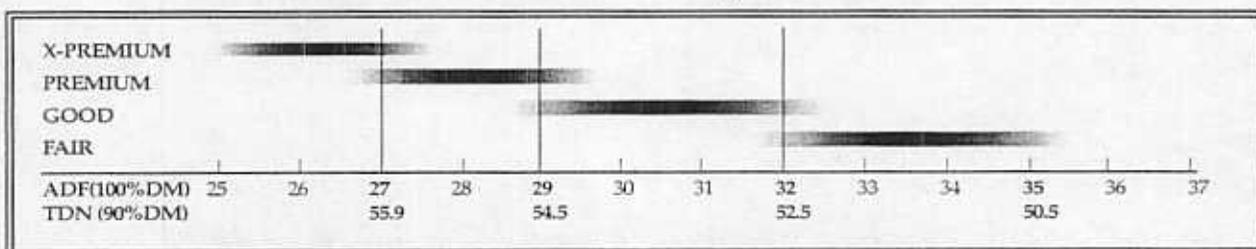
DEFINITIONS OF HAY PRODUCT CATEGORIES:

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.