

**CHOOSE A LAB THAT CHOOSES EXCELLENCE**  
**The 'NFTA Proficiency' Program**  
**and the 'California Recognized' Program for Forage Testing Labs**

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**ABSTRACT**

The California Hay Testing Consortium (CHTC) was formed 4 years ago as an all-volunteer group to focus efforts on problems with hay testing in California. It has made a number of recommendations which members feel have made incremental gains in the performance of hay testing in California. However, the seemingly long-standing and economically important differences between lab values from different labs remains an intransigent problem in the alfalfa-dairy industry. It's worth hundreds of millions to the industry as a whole, and small fortunes to individual growers, brokers, or dairymen. How can customers be assured that a lab is conducting their sample analysis without bias, accurately, and can come up with the same answer each time? The CHTC has put together a program which 'tests the tester', in cooperation with the National Forage Testing Association (NFTA) Proficiency program to meet California's needs. The 'California Recognized' program is stricter than NFTA for ADF<sup>2</sup>, NDF and CP of alfalfa hay, but the NFTA program evaluates the 'overall' performance for all forages and measurements. Both are important. Ten California labs attained NFTA Proficiency in 1999, and at least one 'California Recognized' category. Customers of laboratories who have a strong interest in lab reliability should choose those labs that actively participate and perform well in the NFTA and the 'California Recognized' programs.

**Keywords:** Forage Quality, NDF, ADF, CP, NIR, Laboratory performance

**INTRODUCTION**

How can customers be assured that their lab is doing a good job of forage testing? A sample is sent in to a lab and the results delivered, and large amounts of money changes hands based upon this result. However, a customer does not know if the sample was done accurately unless they take the trouble to test it again with another lab. Even this is problematic, since it is virtually impossible to accurately split a sample without grinding it first. Furthermore, who's to know the second lab is accurate?

Good labs are distinguished primarily by building a reputation for excellence and reliability. However, most people are not familiar with the details of lab methods. There is a lot of devil in those details! The standard hay test is currently to test for ADF, NDF and CP, in addition to DM.

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<sup>2</sup> ABBREVIATIONS: ADF=Acid Detergent Fiber, NDF=Neutral Detergent Fiber, CP=Crude Protein, TDN=Total Digestible Nutrients calculated from ADF, DM=Dry Matter, RFV=Relative Feed Value, CHTC=California Hay Testing Consortium, NFTA=National Forage Testing Association, NIRS=Near Infrared Spectroscopy.

ADF is then used to calculate TDN, and in some areas, ADF and NDF are used to calculate RFV. There are many variations on the techniques used to measure these lab parameters, including variations on the wet chemistry methods, automated fiber systems, different DM methods, and NIRS techniques (there are variations in calculations of TDNs as well, but that's another discussion—all California labs appear to be using a single TDN equation at this point).

Although it would be desirable for all labs to use exactly the same lab method, this is not always feasible, since some rapid methods (especially NIRS) can actually be quite reliable and repeatable, and have the added advantage of quick turnaround of sample results. However, the techniques used by commercial labs MUST be able to match very closely those results obtained by time-tested wet chemistry techniques approved by national bodies as 'reference techniques'. The best way (and the only way I know of) to objectively differentiate between labs' performance is to evaluate performance in regional and national collaborative quality-control programs.

### **NATIONAL FORAGE TESTING ASSOCIATION 'PROFICIENCY' PROGRAM**

There are approximately 24 commercial forage testing labs in California and over 200 labs nationwide. In the past two years, two or three additional forage testing labs have entered the scene in California. In this competitive atmosphere, it is important to choose those labs that are making significant efforts to produce accurate forage testing results and maintain quality lab operations. Participation by a lab in national and regional programs is a strong signal that the lab is interested in controlling the quality of their results.

The National Forage Testing Association (NFTA) was formed in 1976 to improve the accuracy of hay testing and standardize techniques nationwide. The NFTA tests over 140 labs each year nationwide, and awards the 'Proficiency Certification' label to those labs that meet specified criteria.

The NFTA recommends forage-testing methods to laboratories and works with the AOAC (Association of Official Analytical Chemists) to help approve 'reference methods' for the analysis of forages. They have published a methods manual which is now on the World Wide Web and available in print form. They have published a 'Quality Control' Methods manual, which is also available to labs. It is an all-volunteer organization, sponsored by the American Forage and Grasslands Council, and the National Hay Association. Further information on the NFTA can be found at:

*<http://www.foragetesting.org/index.html>*

**Approach.** The NFTA takes the view that for a lab to be certified as being 'proficient', it should handle any type of forage sent to it for analysis. Six carefully split samples are sent each year by NFTA to member labs. A member lab must return a value that must fall within a certain critical value, on the average for the six samples, to be given the 'proficiency' label. An individual lab's value is compared with a 'reference value', which is NFTA's best estimate of the true value for that sample (this reference value is important—it is generated by picking only those labs that are running approved methods,

and then throwing out the top and bottom 'outliers'—it's probably the best way of measuring the 'true value' of a sample). The samples include 4 alfalfa hay samples from all over the US (including some from California), one grass hay, and one corn silage sample. Both the accuracy (ability to match a true mean) and repeatability (ability to give the same result in duplicates) are evaluated.

## THE 'CALIFORNIA RECOGNIZED' PROGRAM

The California Hay Testing Consortium (CHTC) began in 1995 as an all-volunteer organization consisting of hay growers, UC scientists and CE personnel, lab representatives, dairy nutritionists, and others interested in hay testing. It has objectives similar to NFTA, but with a focus on hay testing in California. In 1998, the CHTC offered the "California Recognized" program (CRP) for the first time, a program specific to alfalfa hay, using more stringent guidelines than the NFTA program. This is the second year that we have evaluated and listed 'California Recognized' labs.

Publications related to the California Hay Testing Consortium can be obtain through accessing the California Alfalfa Workgroup Website:

*<http://agronomy.ucdavis.edu/alfalfa.wg/HOME.HTM>*

**Approach.** The philosophy behind the California program is similar in spirit to the NFTA proficiency program, but different in its specifics. Whereas NFTA requires labs to do well, on the average, for all analyses (CP, ADF, NDF, CP) for all forages (alfalfa, corn, and grass), the California Program is specific to alfalfa and specific to analyses (only ADF, NDF, and CP). Whereas the NFTA program asks: "Is this an overall good forage lab?", the California Program asks: "Does this lab do a good job on ADF, NDF, or CP of alfalfa hay?". Since some California labs do not measure silages, and some others do not do NDF or CP, it is possible to fail the NFTA program and pass the CA program. Additionally, since the CA criteria for specific analyses are stricter than NFTA, it is possible to pass the NFTA program and fail a specific analysis in the 'CA Recognized' program. As in the NFTA program, both the accuracy (ability to match a true mean) and repeatability (ability to give the same result in duplicates) are evaluated for the California Recognized Program. The criteria for passing or failing were set up by meetings of the Consortium, and are subject to periodic review. The labs themselves helped to set up these criteria, along with their customers and University scientists.

**Methods.** Results from the four NFTA alfalfa hay samples (see description above) are sent to an independent evaluator elected by the CHTC (usually a University of California scientist) and evaluated using more stringent criteria than the NFTA program. Labs must participate in NFTA to be eligible for the California Recognized Program. This program evaluates specific lab analyses (ADF, NDF and CP) separately, only for alfalfa hay. When labs have been given the 'California Recognized' status, they receive a certificate developed by Marsha Campbell Mathews (UCCE Stanislaus Co.), and may use that status in their reports and promotional material, and are listed in an annual publication published by the California Alfalfa & Forage Review (published by the California Alfalfa

Workgroup and the California Alfalfa & Forage Association) in the summer and again in the Alfalfa Symposium Proceedings in December.

### **HOW TO CHOOSE A GOOD LAB**

Below, we have listed those labs that have received the 'NFTA Proficiency' and 'CA Recognized' label for 1999 (Table 1). In this listing, no endorsement or disparagement of any lab is intended or implied. A complete listing of NFTA labs of the US is available through the NFTA website (see above). A complete listing of other California forage testing labs is available from the author. Examination of Table 1 should be quite helpful as a first step in choosing reliable lab in California.

Probably the ideal would be to choose a lab that is **both** NFTA Proficient and California Recognized for CP, ADF, **and** NDF. Although accuracy of **all** forage analyses is important, the California alfalfa industry may be especially interested in the ADF values (ADF is used to calculate %TDN). The California program helps in this process, since ADF and other measured values are evaluated separately. However, CP and NDF are commonly used by nutritionists, and will likely be increasingly used for trading in the future.

Some NIR labs have claimed that their calibrations are 'checked against an NFTA or a University lab'. However, they do not participate themselves or 'put themselves to the test' in these programs. Simply using an NFTA lab for a few wet chemistry samples does not test that NIR lab's ability to routinely put out good data, and is not the same as full participation in these programs.

Overall, it is clear that a number of labs have done well with ADF and CP measurements. Crude Protein tends to be a more repeatable measurement than ADF, and the only lab that did not attain California Recognized status for CP actually does not run CP analysis, so did not submit data. There are a number of labs that have had difficulties with NDF measurements. This is also true on a national basis with NFTA labs, so is not surprising. Part of this is not the fault of the labs, but related to the lack of a nationally AOAC-approved NDF procedure, so a number of labs are likely running slightly different procedures. In the future, we expect NDF to be in greater demand by nutritionists and hay marketers alike, and so further standardization of NDF procedures should be an important goal for future NFTA and CHTC efforts.

### **(NOT SO) EMBARRASSING QUESTIONS YOU CAN ASK A LAB**

So, now you've chosen a lab out of the listing below, a lab that has elected to participate in both national and regional quality control programs. You're definitely one-up on the game, since there are other labs which have chosen not to participate (actually some additional CA labs are still in the process—it takes more than a year for a lab to sign up, run through the NFTA split sample test, and become 'proficient' or 'CA Recognized'—so we should have a greater number of participants in coming years).

However, with any lab, concern about reliability of lab results may continually crop up. These quality-control measures are good, but they're not full proof. It is still possible for two NFTA labs to come up with different results, much to the chagrin of their customers. Here is a listing of questions that you can ask your laboratory, to assure yourself that they are doing everything they can to give you high-quality results:

**Questions to ask laboratories when concerned about reliability of results:**

1. (All labs) Do you actively participate in NFTA and local programs such as the CA Recognized program? (the reasons for this should be obvious)
2. (All labs) Do you have a Quality Assurance Program for your lab, and do you routinely run Quality Control samples? (NFTA has recently published a QA manual for forage testing labs, which all labs should have available. The running of well-known values through any testing program is a good way of monitoring routine performance).
3. (All Labs) Do you grind the whole hay sample, and do you completely mix the sample before sub-sampling for forage quality? (If the sample is split before grinding, it is not likely to represent the sample you so painstakingly obtained. Sample-handling procedures may be a large part of the lab-lab variation. With the exception of a small portion taken for an 'as-received DM', labs should grind the whole sample and thoroughly mix the sample before subsampling for lab analysis).
4. (All Labs) Do you use NFTA-approved methods for DM, ADF, NDF, and CP? (Changes in the lab methodologies could lead to greater variation or bias—use of the same methods helps labs come up with the right answer more consistently. This is especially important with ADF and NDF, values that are defined by the method. These methods are available on the NFTA website)
5. (All labs) Do you report your data standardized to 100% DM basis (Data from different labs should be compared on a 100% DM basis. Other expressions such as as-received or 90% DM basis may be interesting, but the 100% DM data should be reported)
6. (For NIRS labs): How do you update and support your NIR calibration? (NIR labs must have a method for continually updating their calibration—this can be done with their own wet chemistry capability, or by sending samples out, or by contracting with other entities to help with this process. The wet chemistry values themselves should be from an NFTA-proficient lab. Simply running the same calibration without a method for updating is not an acceptable management technique for NIR instruments)
7. (For NIRS labs): How do you monitor your machine performance? (NIR instruments can be quite effective and repeatable, but require continual monitoring. Monitoring of the machine performance is separate from the updating of calibrations, and both should be done on a regular basis).
8. (For NIRS labs): How do you handle a sample that is outside your calibration—an 'H outlier'? (Even a well-run NIR lab will encounter samples that do not fit the calibration. Samples with high 'H values' should be rerun with wet chemistry. Labs that report data with high 'H values' without

comment or discussion, or don't have a policy for handling 'H outliers' should be considered suspect).

These questions are important questions affecting your labs' performance. They will only be 'embarrassing' to those labs that are not paying attention to quality control issues—most high quality forage labs should be able to answer these questions without difficulty.

### **THE FUTURE**

As the value of forage testing increases in the market, the pressure to obtain more accurate results also increases. Next year (2000), the NFTA is tightening their standards for 'Proficiency' for participating labs on a national basis. Additionally, for California Recognition next year, participating labs will need run two additional alfalfa hay samples for the California recognized program, and continue with strict criteria for ADF, NDF, and CP analysis of alfalfa hay. These will give greater assurance that we are 'testing the testers' in a vigorous way. These two samples results will be combined with the NFTA sample results, and be used to confer the 'California Recognition' label in the year 2000. These changes were made in CHTC meeting of participating labs and lab customers in October 1999. Further efforts to develop better ways for 'blind testing' laboratories are underway. For further information about these changes, contact the author.

### **CONCLUSIONS**

In the process of assuring that a laboratory is making every effort to improve the quality of their hay testing results, it is important to choose labs that are actively engaged in national and regional quality control programs. Ideally, labs that perform well on both the NFTA Proficiency program, and the 'California Recognized' program for ADF, NDF, and CP should be preferred. California hay people should be particularly interested in ADF values (from which TDN is calculated) but NDF and CP are also widely used. NDF is likely to be more widely used in the future. As time goes, on, and as a larger number of laboratories compete for your business, their performance in third-party performance tests such as these becomes more important.

**Table 1. 1999 Listing of 'NFTA Proficient' and 'California Recognized' Hay Testing Laboratories.**

Participating Labs and Contacts	Category	1999 NFTA Proficient	1999 California Recognized		
			ADF	NDF	CP
<b>A&amp; L Western Labs</b> Modesto, CA Bob Butterfield, 209-529-4080	<b>Chemistry</b>	✓	✓		✓
<b>ACX, Inc</b> Long Beach, CA John Pu, 562-437-8567	<b>Chemistry</b>	✓	✓	✓	✓
<b>Advanced Crop Technologies</b> Imperial, CA Amin Abdelmoien, 760-355-0077	<b>Chemistry</b>	✓	✓		✓
<b>Basin Agri-Serve</b> Merrill, OR Tom Janecke, 541-798-5112	<b>Chemistry</b>	✓	✓		✓
<b>Kruse Grain &amp; Milling</b> Ontario, CA Grant Gilman, 909-983-3444	<b>Chemistry</b>	✓	✓	✓	✓
<b>JL Analytical Services</b> Modesto, CA Mary Jacobs, 209-538-8111	<b>Chemistry</b>	✓	✓	✓	✓
<b>JL Analytical Services</b> Modesto, CA Mary Jacobs, 209-538-8111	<b>NIRS</b>	✓	✓	✓	✓
<b>Mid-State Lab, LLC</b> Visalia, CA Fred Shore 209-651-9044	<b>Chemistry</b>	✓	✓	✓	✓
<b>Petaluma Hay Analysis</b> Petaluma, CA Don Waite, 707-763-6891	<b>Chemistry</b>		✓		
<b>Sierra Testing Service</b> Acampo, CA Steve Seifert, 209-333-3337	<b>NIRS</b>	✓			✓
<b>Stanworth Crop Consultants</b> Blythe, CA Aron Quist, 760-992-3106	<b>NIRS</b>	✓			✓

Note: This listing is provided for informational purposes only—no endorsement or disparagement of any lab is intended or implied. For a complete listing of NFTA labs, consult the NFTA website, for a complete listing of all (including non-participating) California forage testing labs, write to the author (D.H. Putnam, Dept. of Agronomy and Range Science, Univ. of California, Davis, CA 95616.).