

## ***NIRS Forage and Feed Testing Consortium***

**“Dedicated to increasing the accuracy and knowledge of NIRS testing.”**

# **NIRS Consortium Membership NEWS**

July/August, 2001

### **Board Elections 2001**

The results for the NIRS Consortium Board elections that took place in July are as below. All directors have been elected for a term of 3 years beginning October 1, 2001. Each person elected fills the sector within the Consortium specified.

Steve Peterson: Commercial sector  
Neal Martin: University or Gov't. sector  
Don Sapienza: Seed Research sector

Thank you all for your participation in this year's election.

### **Consortium Officers 2001**

Officers for the NIRS Consortium were elected by the Board of Directors on September 5, 2001. All officers will begin their terms on October 1, 2001. The President has a term of two years, all other officers a term of one year. The officers-elect are as follows:

Steve Peterson: President  
Don Sapienza: Vice President  
Mick Goedeken: Secretary/Treasurer

### **New Consortium Business Office Location**

New contact information for the Consortium Business office is as follows:

Patty Laskowski  
NIRS Consortium  
Agronomy Dept.  
1575 Linden Drive  
Madison, WI 53706  
pmlaskowski@facstaff.wisc.edu

office phone: 608-661-7678  
alternate phone: 608-262-6203  
fax: 608-265-3437

### **Update on Corn Silage NDFd Equation Work**

Eighty-four samples have been selected so far from spectra sent in from labs participating in the Consortium Corn Silage NDFd equation development. UW Soil and Forage Lab in Marshfield already has 70 of these samples completed. The protocol decided upon by members interested in this equation was to run each sample in four replicates, on 1mm Wiley ground samples, for 48 hours, by in vitro method. The Consortium would like to thank Dairyland Labs, AgSource Coop, UW Soil and Forage Lab, Olson Biochemistry

Lab, Dairy Tech Labs, and Pioneer HiBred for their participation in sample submission for this collaborative effort.

Any labs with questions or wishing to join the project, please contact Paolo Berzaghi or Patty Laskowski.

## Instrument Monitoring Website

The Consortium has completed an Instrument Monitoring Website in which all Consortium Members **should now go** to report weekly instrument diagnostics and check cell output. This website may be accessed from the [Consortium Website](#).

Each participating lab is able to input weekly diagnostic results such as NIR Max, Rep, K, PHI, and NIR Wave Err, as well as the output of one routine check cell scan per week. Each lab is able to get immediate feedback of instrument functioning as well as long-term monitoring by our instrument specialist.

We are also able to list several email addresses into each lab's account for sending back results from the website. In this way, each lab's instrument technician(s) as well as lab manager can receive a report on weekly instrument functioning. **If you would like your email address added so that you will receive a report, returned from the website, let Patty know.**

If your lab is currently not participating and would like to, OR if your lab has another instrument for which you would like to submit reports, please let us know and we can add an account.

## NFTA Moisture Determination

The National Forage Testing Association (NFTA) is changing their

procedure for residual moisture determination. The procedure currently involves using 135° C, but will change next year to 105° C. The Consortium currently has an equation that detects residual dry matter in samples scanned by NIRS. We believe that this calibration can be adjusted to reflect the new NFTA procedure.

We have asked labs to participate (see email request sent 8-23-01) in sample submission so that Paolo can do the evaluation required to make the adjustment on the current calibration. Several labs have responded and are already sending samples. We need more participation to complete this adjustment.

We are asking that each lab submit the following:

A total of 18 samples of 15 to 20 g each:

- 6 corn silage
- 6 hay (legume, grasses and mixtures)
- 6 silages (legume, grasses and mixtures)

Samples must be already dried (either oven or microwave) and ground by 1mm Udy. Within each class (corn silage, hay, or silages), select samples that cover the largest range in moisture you would expect in your lab. Considering all 18 samples, we would like to have a range in moisture between 3 and 12%.

Please send a spectra file of the samples to Paolo: [pberzaghi@facstaff.wisc.edu](mailto:pberzaghi@facstaff.wisc.edu)

Please send the samples directly to Paolo at:

Paolo Berzaghi  
NIRS Consortium  
1925 Linden Drive West  
Madison, WI 53706  
608-264-5232

Please indicate on the box:  
“NFTA DM Calibration”

## Ring Test: Grinding & Drying Method Evaluation

The Consortium is conducting a ring test to evaluate the differences in drying and grinding procedures between labs. Some level of standardization in sample handling between labs is hoped to alleviate problems in updating Consortium equations.

Please see the document, [Ring Test: Grinding & Drying Method Evaluation](#) for a review of the proposed evaluation and for filling out a survey.

**We need all labs' participation in this project.** All information your lab provides will be kept confidential.

## Evaluation and Update of Current Legume Hay Equation

Paolo has been working on updates to the current Consortium legume hay equation, Lhay1097.eqa. Please see his document [Evaluation and attempt to improve the current equation for legume hay \(Lhay1097.eqa\)](#) for his analysis.

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For further information on any of these topics, please contact Patty Laskowski.

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ph: 608-661-7678  
Email: pmlaskowski@facstaff.wisc.edu

## **Ring Test: Grinding & Drying Method Evaluation**

TO: NIRS Consortium Members

FR: Patty Laskowski

Date: 8-27-01

As you know, the Consortium has been working on updates of existing equations as well as working on new equations. In trying to include spectra and wet chemistry results into the general equations, there have been some problems. Differences between labs in sample handling/preparation seems to be an important factor.

Last summer the Consortium conducted a particle size evaluation with the alfalfa breeders. The results of this test showed that by standardizing sample handling and preparation, the alfalfa breeders were able to improve repeatability within their own lab and were better able to detect smaller differences between samples.

The Consortium is proposing a similar evaluation with all the labs. We would like to know if your lab would be willing to participate in a ring test that would evaluate drying and grinding procedures. We are hoping that each lab will be able to improve their own repeatability and increase the ability to detect smaller differences between samples.

The process would involve sending bulk samples of corn silage, legume silage, and legume hay products to each lab and having the lab carry out sample preparation from drying and grinding to NIRS scanning.

All data and information that a lab produces or provides will be kept confidential.

### **PLEASE DO THE FOLLOWING:**

- (1) Respond to Patty with your lab's commitment to participate.
- (2) Complete the Survey that follows on page 2.

Survey:

Lab Name:

A. Drying:

1. Method: oven or microwave

2. Moisture:

- a. What is your mean residual moisture for the last 3 to 4 weeks?
- b. What is the range of residual moistures that you have been getting for the last 3 to 4 weeks?
- c. What is the time between removing from oven (including grinding) and scanning?

B. Grinding:

a. Briefly outline your grinding method, including cleaning between samples.

- b. Type of grinder(s):
- c. Model of grinder(s):
- d. Grinder's screen size:
- e. How often is the screen changed?
- f. How often are the blades sharpened?

C. If subsampling is part of your method, how is this done both in the fresh sample and at grinding.

PLEASE RESPOND BY EMAIL, FAX, OR REGULAR MAIL TO:

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Agronomy Dept.  
1575 Linden Drive  
Madison, WI 53706  
ph: 608-661-7678  
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## Evaluation and attempt to improve the current equation for legume hay (Lhay1097.eqa)

To: NIRS Consortium  
From: Paolo Berzaghi  
Date: August 24, 2001

Following our annual Consortium meeting I've been receiving spectra and chemistry data from 4 labs in the Consortium. The total number of Alfalfa hay samples received so far is 654. The objective of my work was to use these samples to test and improve the current legume hay equation (lhay1097.eqa).

### Data sets:

1. ISI expandable	594
2. Samples used to expand ISI	1013
3. Updates received from commercial labs in 2001	654
4. NFTA AH samples for year 1999 and 2000	10

### Equations tested:

- A. Lhay1097.eqa –developed combining data set 1 and 2;
- B. ISIEXP.eqa – developed using only ISI expandable. I've chosen to test this equation to evaluate the ISI expandable equation;
- C. Consort.eqa – developed using only consortium samples (data sets 2 and 3);
- D. Lhay0801.eqa – developed using data set 1 with the addition of a selection of samples from data set 2, 3 and 4. This would be like an updated version of lha1097.cal;
- E. The last method was to apply Local calibrations using data set 2, 3 and 4 combined into one database and let the software calculate specific equations for each sample being predicted (see Consortium meeting 2000).

### Validation sets

- Samples of data set 3 (no. 591) not used in lhay0801.eqa.
- Samples of data set 4 (no. 8) not used in lhay0801.eqa.

The Standard error of prediction (SEP), Bias, standard error of prediction after bias correction (SEPC) and  $R^2$  between wet chemistry and NIR prediction were reported from the test equations.

Evaluation of methods:

*Validation set from data set 3*

Table 1 reports the results of validation for data set 3. Red bold values are the worse performance; black bold values indicate the best performance.

It is clear that Local calibrations are superior for all of three variables, with a reduced SEP, bias and SEPC.

For the prediction of ADF, the performances between ISIEXP, Lhay1097, Lhay0801 and Consort were similar. That means that at least for ADF, ISIEXP already provides a good equation and the consortium updates had only a marginal improvement.

Consortium equations improved prediction of CP compared to ISIEXP, reducing the SEP and SEPC of about 0.1 %DM. The attempts to improve the current equation Lhay1097 only reduced the bias. Lhay1097 seems in fact to underestimate CP content of about half a unit. The equation can be fixed with a simple bias correction.

ISIEXP failed to accurately predict NDF. The major problem of this equation is the large bias, which indicates an overestimation of NDF of more than 3 units. The differences between the current equation and the improvement were small. However, none of the new calibrations improved the old one. This was one of my most important goals, but at this point the only way to improve NDF prediction is to change the calibration method and use Local.

TABLE 1: Performance of the different equations in the prediction of samples of alfalfa hay received from labs in 2001 (data set 3).

Method	SEP	Bias	SEPC	RSQUARE
ADF	-----%DM-----			
ISIEXP	1.81	0.16	1.80	0.85
LH0801	1.83	-0.36	1.79	0.86
LH1097	<b>1.98</b>	<b>-0.58</b>	<b>1.89</b>	<b>0.84</b>
LOCAL	<b>1.48</b>	<b>0.09</b>	<b>1.48</b>	<b>0.90</b>
CONSORT	1.87	-0.20	1.86	0.85
CP				
ISIEXP	<b>0.94</b>	-0.10	<b>0.93</b>	<b>0.85</b>
LH0801	0.80	0.17	0.78	0.90
LH1097	0.93	<b>0.48</b>	0.80	0.89
LOCAL	<b>0.69</b>	<b>-0.02</b>	<b>0.69</b>	<b>0.92</b>
CONSORT	0.83	0.16	0.82	0.89
NDF				
ISIEXP	<b>3.96</b>	<b>-3.33</b>	<b>2.14</b>	<b>0.88</b>
LH0801	2.05	-0.27	2.03	0.89
LH1097	1.97	-0.54	1.89	0.90
LOCAL	<b>1.52</b>	<b>0.09</b>	<b>1.52</b>	<b>0.94</b>
CONSORT	2.13	-0.59	2.04	0.89

*Validation set from data set 4 (NFTA)*

Although it has a limited number of samples I also wanted to report the performance of the calibration in prediction of NFTA samples from the last 2 years.

Again Local calibrations are superior for all of the variables. Only the Consort equation does better in the prediction of NDF.

With this validation data set Consortium equations show their improved accuracy compared to ISIEXP for all the variables. Also, the validation of NFTA samples shows some improvement of the new equations compared to the current Lhay1097. In fact, Lhay0801 had smaller bias and slightly better SEPC for CP and ADF, and a reduced (SEPC) of about 0.3 %DM (1.33 vs. 1.62 %DM)

TABLE 2: Performance of the different equations in the prediction of samples of alfalfa hay received for NFTA testing during 1999-2000 (data set 4).

Method	SEP	Bias	SEPC	RSQUARE
ADF -----%DM-----				
ISIEXP	<b>0.78</b>	0.21	<b>0.79</b>	<b>0.97</b>
LH0801	0.46	0.03	0.48	0.99
LH1097	0.62	<b>0.37</b>	0.52	0.99
LOCAL	<b>0.27</b>	<b>0.08</b>	<b>0.27</b>	<b>0.99</b>
CONSORT	0.63	0.31	0.57	0.99
CP				
ISIEXP	<b>1.53</b>	0.41	<b>1.55</b>	<b>0.97</b>
LH0801	1.28	-0.37	1.30	0.97
LH1097	1.39	<b>-0.59</b>	1.34	0.97
LOCAL	<b>0.99</b>	<b>-0.37</b>	<b>0.98</b>	<b>0.99</b>
CONSORT	1.01	0.01	1.07	0.98
NDF				
ISIEXP	<b>4.45</b>	<b>-4.11</b>	<b>1.8</b>	<b>0.98</b>
LH0801	1.54	0.89	1.33	0.96
LH1097	1.61	-0.48	1.62	0.95
LOCAL	1.15	0.08	1.21	0.97
CONSORT	<b>0.90</b>	<b>-0.28</b>	<b>0.90</b>	<b>0.98</b>

Summary of method evaluation

- The current Lhay1097 performed relatively well.
- The attempted updates did not improve performances in the prediction of Lab samples, but had an advantage on the prediction of NFTA samples.
- The only method that always improved predictions was using Local calibrations.

## Effect of Methods within each Lab

The performance of the different equations or methods by each Lab that provided samples are summarized in Table 3. For brevity I've reported on Lhay1097, Lhay0801 and Local.

The level of accuracy of the 3 methods was different between labs. In other words, it seems that one equation cannot fit all the labs. These results may reflect differences in wet chemistry, but they are also affected by differences in sample preparation. I think this is an issue that must be clarified. We intend to have a trial to evaluate particle size of ground samples generated by the different labs. This will help us to standardize grinding procedures and reduce the effect of particle size on the accuracy of prediction of labs in the consortium.

Lab #3 and #4 are those that have contributed with the largest number of samples. Those are also the labs that have the most consistent improvement by local and also by the lhay0801.

Bottom line:

- We need to standardize grinding and sample handling procedure between labs.
- If you provide spectra and chemistry data we can improve prediction for your lab.
- We would like to continue updates of Consortium equations after grinding evaluation and standardization.

TABLE 3: Performance of the different equations or methods by each lab providing samples of alfalfa hay in 2001.

Method	Lab	SEP	Bias	SEPC	RSQUARE
<b>ADF</b>					
LH0801	1	1.86	0.50	1.79	0.89
LH0801	2	1.55	-0.02	1.55	0.85
LH0801	3	1.82	-0.58	1.73	0.82
LH0801	4	1.85	-0.28	1.83	0.88
LH1097	1	2.03	0.92	1.82	0.89
LH1097	2	1.72	0.43	1.66	0.82
LH1097	3	2.07	-1.14	1.73	0.82
LH1097	4	1.88	-0.28	1.86	0.87
LOCAL	1	1.90	0.56	1.82	0.88
LOCAL	2	1.37	-0.10	1.37	0.88
LOCAL	3	1.36	0.09	1.36	0.88
LOCAL	4	1.55	0.04	1.55	0.90
<b>CP</b>					
LH0801	1	0.86	-0.52	0.69	0.93
LH0801	2	0.70	0.23	0.66	0.89
LH0801	3	0.67	-0.10	0.66	0.93
LH0801	4	0.92	0.55	0.74	0.90
LH1097	1	0.73	-0.09	0.72	0.92
LH1097	2	0.85	0.64	0.56	0.92
LH1097	3	0.71	0.19	0.68	0.92
LH1097	4	1.15	0.85	0.77	0.90
LOCAL	1	0.82	-0.16	0.80	0.91
LOCAL	2	0.79	0.37	0.69	0.90
LOCAL	3	0.61	-0.09	0.61	0.94
LOCAL	4	0.73	0.04	0.73	0.90
<b>NDF</b>					
LH0801	1	2.17	0.56	2.10	0.89
LH0801	2	3.02	-0.53	2.97	0.66
LH0801	3	1.81	0.18	1.80	0.89
LH0801	4	2.15	-0.93	1.94	0.90
LH1097	1	2.18	0.78	2.04	0.90
LH1097	2	2.60	-0.24	2.59	0.74
LH1097	3	2.07	-1.25	1.65	0.91
LH1097	4	1.69	0.07	1.69	0.92
LOCAL	1	2.31	0.83	2.16	0.88
LOCAL	2	2.63	-0.52	2.58	0.74
LOCAL	3	1.43	0.11	1.43	0.93
LOCAL	4	1.25	0.01	1.25	0.96