EFFECTS OF SAMPLING AND SAMPLE HANDLING ON ALFALFA HAY TEST RESULTS

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ABSTRACT

To investigate the potential variability in hay testing results which could be associated with the either different sampling tools (forage probes) or the "ability" of the individual using the sampling tool, a small study was conducted. Two different lots of hay at the University of California, Davis, were selected and each lot was sampled by three different individuals using three different sampling tools. Each individual collected 20 cores of hay from each lot of hay using each forage probe. The entire core sample was ground through a 1 mm screen using a Wiley mill. Ground samples were analyzed for crude protein by Kjeldahl analysis and ADF and NDF according to the detergent fiber scheme. No differences in chemical composition of hay tests results were observed for either type of forage probe or individual sampling to lot of hay. If an adequate number of bale cores are taken from a lot of hay, the sampling tool or individual obtaining the sample should not influence the accuracy of the hay test results.

Key Words: alfalfa, hay testing, forage probe

INTRODUCTION

Variability in hay testing results can be a source of great frustration to hay brokers and hay buyers. A difference as small as one percent TDN can be a break point for price and an issue for debate. This debate usually occurs when a lot of hay is sampled after purchase by the buyer to verify the seller's test results. Obtaining an accurate estimate of the quality of a lot of hay begins with sampling. Improper sampling techniques can contribute greatly to variability in hay tests results. Sampling techniques should ensure that the sample sent to the lab for analysis accurately represents the lot of hay. Chemical analyses also have limitations in regard to accuracy. Accepted methods for hay testing have been previously described in Testing Alfalfa Hay for Its Feeding Value (Bath and Marble 1989).

This study was conducted to verify the validity of the sampling procedures described by Bath and Marble (1989) and to begin to explore the specific effects of sampling personnel and sampling tool on hay testing results. The study is a preliminary investigation. A limited number of forage probes were evaluated with only two lots of hay. More comprehensive research should be conducted in the future.

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PROCEDURES

The study was conducted at the University of California, Davis. Two different lots of hay, one at the Dairy Facility and one at the Feed Mill, were selected. Each lot was sampled by three individuals using three different hay probes. Sampling of the lot was random with no effort made to sample the same bales within a lot. Forage probes included the Penn State Forage Sampler (PSU), an 18-inch probe with an internal diameter of 3/4 inches, The Forageurs Hay Sampler, a 24-inch probe with an internal diameter of 5/8 inches, and a sharpened golf club shaft, a 16-inch probe with a 3/8 inch internal diameter.

Each individual took 20 bale cores from each lot at random with each of the three probes. The 20 cores were pooled into a single plastic bag and mixed by hand, the bag sealed, and delivered to the lab. The entire sample was ground through a 1 mm screen using a Wiley mill. Crude protein was determined by Kjeldahl analysis according to AOAC (1994), acid detergent fiber (ADF) according to Goering and Van Soest (1970), and neutral detergent fiber (NDF) according to Van Soest et al. (1991). Total digestible nutrients (TDN) was calculated according to the California equation based on ADF (Bath and Marble 1989) which was TDN (100% of DM) = 82.38 - (0.7515 x ADF%) and then converted to a 90% dry matter basis for discussion.

Data were analyzed using SAS (1988). The model included as main effects: lot of hay, individual, and forage probe. An analysis for possible interactions between main effects found no interactions.

RESULTS

Laboratory analyses of hay core samples by sampling tool and personnel are shown in Tables 1 and 2. Type of sampling tool (forage probe) did not significantly affect ADF determination (Table 1). Although data are not shown, lots of hay were different for ADF content which was anticipated since hay lots were from different fields and cuttings. Only ADF content was affected by the individual obtaining the core sample regardless of the forage probe used (Table 2). The ADF content of samples obtain my 'Ed' were significantly higher than those obtained by 'Barb'. 'Tom' was intermediate to 'Ed' and 'Barb'. A similar response was observed for TDN with 'Ed' obtaining a lower TDN value compared to 'Barb' for hay lots.

The lot of hay at the Feed Mill was previously sampled using a Penn State core sampler after harvest, and the bale cores sent to a commercial lab using NIRS techniques. The lab results are provided for comparison only (Table 3). Results of the two lab tests were within 5% of each other.

DISCUSSION

Variability in laboratory analyses for a given lot of hay will be small if the bale core samples accurately represent the lot of hay. In the present study, laboratory analyses were not affected by the type of forage probed used, but individual obtaining the sample did influence ADF content. The difference between individuals was small. The sharpened golf club shaft was the easiest probe to use in regard to time required to collect the sample and the amount of physical effort needed. However, it should be noted that there a numerous types of forage probes used so one can not conclude that the type of probe does not influence hay test results. With the three probes used in the present study, 20 bale cores were obtained for each probe. However, probes with a larger internal diameter are physically more tiring to use. They didn't get the name "bellybuster" for nothing!t In addition, the larger bore probes collect a larger sample size which may exceed the needs of the lab. This would require that the lab subsample the hay core sample which could also introduce another source of error in the hay test results. If the goal of sampling is to obtain a sample that accurately reflects the forage within a given lot of hay, a small diameter forage probe may be the probe of choice. However, at the present time there is not sufficient data available to make specific recommendations on probes, sample size, and number of cores per lot.

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Table 1. Effect of sampling tool used to collect the forage sample on nutrient content.

	Tool			
Item[1]	**Golf Club**	**Forageur**	**PSU**	**Probability**
DM	**87.4**	**86.8**	**87.4**	**.12**
ADF	**29.0**	**29.3**	**29.2**	**.58**
NDF	**38.5**	**38.8**	**38.2**	**.51**
CP	**22.9**	**22.6**	**22.8**	**.78**
Ash	**9.3**	**9.1**	**9.3**	**.20**
TDN	**54.5**	**54.3**	**54.4**	**.58**

[1] **All items are on a 100% dry matter basis except TDN, which is on a 90% dry matter basis.**
[2] **Probability of significance. To be declared significant, a probability of .05 or less was required (P<.05).**

Table 2. Effect of person collecting the forage sample on nutrient content.

	Person			
Item[1]	Barb	Tom	Ed	Probability[2]
DM	87.5	87.0	87.0	.19
ADF	28.7[a]	29.2[a,b]	29.6[b]	.04
NDF	38.3	38.6	38.7	.71
CP	22.8	22.7	22.8	.95
Ash	9.3	9.2	9.3	.66
TDN	54.7[a]	54.4[a,b]	54.1[b]	.58

[1] All items are on a 100% dry matter basis except TDN, which is on a 90% dry matter basis.
[2] Probability of significance. To be declared significant a probability of .05 or less was required ($P<.05$).
[a,b] Means in the same row with different superscripts are significantly different at $P<.05$.

Table 3. Comparison of test results between a commercial lab and core testing demonstration (100% DM basis).

Item	Commercial Lab	Core Results	% Difference
% ADF	31.8	30.30	4.95
% NDF	37.2	39.25	5.51
% CP	20.9	21.91	4.83