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SAMPLING OF LARGE ROUND AND LARGE SQUARE BALES

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Summary

Four hay probes were used to sample four lots of hay. The lots of hay were as follows: alfalfa large round bales, alfalfa large square bales, alfalfa-grass mix large round bales, and alfalfa-grass mix large square bales. Probes used were as follows: E-Z Probe, John Skogberg handcrafted probe, Utah Hay Sampler, and Frontier Mills probe. Six bales from each lot were sampled. Dry matter (DM), crude protein (CP), acid detergent fiber (ADF), and neutral detergent fiber (NDF) percentages and relative feed value (RFV) were predicted by near infrared reflectance spectroscopy. Bale variation within hay type was much greater than probe variation. Bale variation was significant for all measurements except DM. Probe type only affected NDF% and RFV.

Key Words: Hay Probes, Sampling Technique, Forage Analysis

Introduction

Forage analysis is a widely used tool for balancing rations for ruminant animals and for marketing hay. Laboratory personnel and producers are both concerned with the accuracy of forage quality analyses. Sampling of hay can be the greatest source of variation of hay analysis. To improve accuracy of sampling, it is recommended that a hay probe be used to take several samples ("probes") throughout a lot of

hay. There are several hay probes commercially available and some producers make their own. The objectives of this experiment were to examine the variation of laboratory forage quality constituents due to probes and variation due to differences between bales sampled.

Materials and Methods

Four probes were used to sample four lots of hay. Six random bales within each lot were sampled with each probe. The side of the bale to be probed was assigned four regions, and probes were randomly assigned to regions within each bale sampled.

The probes used in this experiment represent the types often used in South Dakota. Probes used and their dimensions were as follows: 1) E-Z Probe (Techniserve, Inc., Madras, OR) - 1/2-in. internal diameter and 30 in. coring tube with attached canister; 2) a handcrafted probe (John Skogberg, Belle Fourche, SD) - 2 in. internal diameter and 30 in. coring tube with a serrated tip; 3) Utah Hay Sampler (c/o Judy A. Gale, Logan, UT) - 1/2 in. internal diameter and 19 in. coring tube with a serrated tip, auger-like threads on sampling end of coring tube, and attached canister; 4) Frontier Mills (Yankton, SD) - 7/8 in. internal diameter and 30 in. coring tube with a serrated tip, auger-like threads on sampling end of coring tube, and attached canister. A 1/2-in. electric drill was attached to probes to take samples.

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The lots of hay probed were chosen to be representative of hay types and packages typical to South Dakota. The four lots were as follows: 1) alfalfa, large round bales (ALR); 2) alfalfa, large square bales (ALS); 3) alfalfa and grass mix, large round bales (MLR); and 4) alfalfa and grass mix, large square bales (MLS).

Forage quality constituents of all samples were predicted by near infrared reflectance spectroscopy (NIRS) using ISI software (Intrasoft International, University Park, PA), including DM, CP, ADF, and NDF percentages. Relative feed value (RFV) was calculated using the equation recommended by The Hay Marketing Task Force of the American Forage and Grassland Council.

Data were analyzed by the General Linear Model of SAS (SAS Institute, Cary, NC) for a nested factorial design using bales within hay type as an error term.

Results and Discussion

The four lots of hay were different for all measurements ($P < .01$, Table 1). All measures of bales within lots were different except DM ($P < .01$, Table 2). The means and ranges of means for all bales for DM, CP, ADF, and NDF percentages and RFV are 96.4 (96.0-96.9), 15.4 (14.3-16.2), 34.9 (33.8-36.2), 49.9 (48.4-52.0), and 122.7 (118.6-129.0), respectively. While these ranges are not as large as reported by Martin et al., (1992), it agrees with the recommendation for multiple samples within a lot.

Means of samples taken by four probes are given in Table 3. The probe used did not affect

DM, CP, or ADF percentages. Samples taken by the Utah Hay Sampler were lower for NDF% ($P < .05$) and higher for RFV ($P < .01$). The interaction of probe x hay type for RFV tended to be significant ($P < .07$) due to greater variation between bale in alfalfa lots than alfalfa-grass mix lots. The ranges of means of DM, CP, ADF, and NDF percentages and RFV for the four probes are 95.8-96.5, 15.2-15.7, 34.4-35.1, 49.0-50.1, and 119.9-127.2, respectively.

In conclusion, bale variation is substantially higher than variation associated with different probes, even though NDF% and RFV were affected by one probe. This study further showed the need to sample several bales in a lot. Also, the data suggest sampling alfalfa-grass mix hay lots may be less difficult to sample than pure alfalfa hay lots, perhaps due to more leaf and stem separation of alfalfa during baling.

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Table 1. Analyses results by hay type

Measure	ALR ^a	ALS ^a	MLR ^a	MLS ^a	Significance ^b
n	24	24	24	24	
DM, %	97.1	97.2	95.9	95.4	NS
CP, %	21.1	20.4	9.1	10.9	**
ADF, %	30.7	29.5	39.0	40.4	**
NDF, %	40.3	38.4	61.4	59.6	**
RFV ^c	151.9	159.9	88.7	90.5	**

^aALR = alfalfa, large round bales, ALS = alfalfa large square bales, MLR = alfalfa-grass mix, large round bales, MLS = alfalfa-grass mix, large square bales.

^bNS = nonsignificant, ** = P<.01.

^cRFV = relative feed value.

Table 2. Analyses results by bale number

Measure	1	2	3	4	5	6	Significance ^a
n	16	16	16	16	16	16	
DM, %	96.9	96.6	96.3	96.2	96.4	96.0	NS
CP, %	15.7	16.2	15.6	14.3	16.0	14.4	**
ADF, %	33.8	35.0	34.2	35.0	36.2	35.1	**
NDF, %	48.7	49.1	48.4	50.7	50.7	52.0	**
RFV ^b , %	129.0	121.4	126.0	119.9	118.6	121.5	**

^aNS = nonsignificant, ** = P<.01.

^bRFV = relative feed value.

Table 3. Analyses results by probe type

Measure	EZ ^a	SK ^a	UT ^a	YK ^a	Significance ^b
n	24	24	24	24	
DM, %	96.4	96.9	95.8	96.5	NS
CP, %	15.2	15.2	15.7	15.3	NS
ADF, %	34.9	35.1	34.4	35.1	NS
NDF, %	50.1	50.6	49.0	50.0	*
RFV ^c	122.6	119.9	127.2	121.3	**

^aEZ = E-Z Probe, SK = handcrafted probe, UT = Utah Hay sampler, YK = Frontier Mills probe.

^bNS = nonsignificant, * = P<.05 ** = P<.01.

^cRFV = relative feed value.