

A Survey of Forage Quality Following a Flood Year: 1994

A.S. Leaflet R1461

Daryl R. Strohhahn, professor of animal science

Summary

A team of extension livestock specialists and county extension workers collected 362 forage samples from cooperating producers in 55 Iowa Counties. Summaries of the three forage types showed normal feed analysis for energy and protein. Micro minerals were also analyzed with 11% of samples being below National Research Council 1984 selenium and zinc requirements for beef.

Introduction

Iowa experienced record rainfall amounts in 1993 with severe flooding and poor forage quality resulting (see A.S. Leaflet R1251, 1995). But weather patterns returned to near normal the following production year with above average crop production taking place. A recent survey of forage quality when weather was normal or nearly so had not been conducted. Thus extension educators and feed industry representatives were in need of normal forage quality values.

Materials and Methods

A team consisting of extension livestock and agronomy specialists (both field and state) were mobilized with hay probes to collect forage samples from farmers across Iowa. Sampling procedures utilized are outlined in Agronomy extension publication PM-1098, Forage Sampling and Testing. At the time of sample collection, producers were asked to supply the following information: date of harvest, forage type, cutting, approximate stage of maturity, degree of rain damage between cutting and baling, and whether a hay preservative was utilized. Additional information provided by staff was the storage description, type of forage package, estimate of package density and any additional pertinent comments.

Forage samples were placed in plastic bags, identified with county, producer, and sample numbers, refrigerated and transported to Ames for grouping, database work and shipment to the cooperating laboratory. Wet chemistry forage analysis as approved by the A.A.O.C. was performed on all samples by Midwest Laboratories, Inc., of Omaha, Nebraska, and the Iowa State University Veterinary Diagnostic Laboratory at Ames.

Results and Discussion

A total of 362 forage samples from 55 of Iowa's 99 counties were collected and submitted for analysis. All samples were analyzed in duplicate for fiber, energy,

protein and basic minerals by Midwest Laboratories, Inc., and selenium analysis was done by the ISU Veterinary Diagnostic Laboratory. An average of the two analyses for each sample was utilized in this summary work.

Forage types represented in this survey are summarized in Table 1. Slightly over 26% of the samples are alfalfa and clover hay, about 64% mixed legume-grass, and about 11% grass hay. Table 2 shows that approximately 44% of the hay samples were from first cutting harvests, whereas less than 15% came from third or later cutting harvests.

Maturity of the 1994 forage crop was favorable towards quality hay. As Table 2 indicates, producers felt over 70% of their hay crop was early to mid bloom when harvested. The majority of hay samples came from large package harvest systems (see Table 3). Additionally, most hay was stored outside and had no protective covering.

Nutrient analysis averages for three types of forages at four different cuttings are given in Table 4. In comparison to forage samples collected during the 1993 flood year 1994 forages were one to three percentage units higher in crude protein and six to 10 percentage units higher in TDN.

A micro mineral analysis was done on the samples in this survey. Table 4 shows the averages, maximums, minimums and standard deviations for those micro mineral levels. As expected, sodium is below NRC 1984 requirements. Two other micro minerals that can be limiting in Iowa forages are selenium and zinc. Data in Table 5 show what percentage of forages either meet, exceed or do not meet selenium and zinc NRC 1984 requirements. All other micro minerals either met or exceeded the NRC 1984 requirements. Figures 1 and 2 show how the selenium and zinc levels varied based on county location. Forage samples with low levels of selenium seem to occur in the bottom three tiers of Iowa counties and along the Mississippi River. Zinc levels appear to be borderline or below requirement levels in Northwest Iowa and along the Mississippi River.

Implications

The results of this survey gave producers, consultants, and extension specialists a base from which to work when ration formulation was considered.

Acknowledgments

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finally, a great deal of thanks goes to Donna Watson for her excellent work in maintaining sample flow and database integrity.

Table 1. Type of forages and number of samples by cutting.

Forage Type	Number	% of Total
Legume: Alfalfa/clover hay		
First cutting	27	7.5
Second cutting	32	8.8
Third cutting	33	9.1
Fourth cutting	4	1.1
Grass hay		
First cutting	32	8.8
Other cuttings	7	1.9
Grass-Legume hay		
First cutting	100	27.6
Second cutting	68	18.8
Third cutting	52	14.4
Fourth cutting	7	2.0
Total	362	100.0

Table 2. Reported estimated maturity of alfalfa, grass and grass-legume hay.

Maturity Stage	Legume:			Weighted Average
	Alfalfa/Clover	Grass	Grass-Legume	
Early bloom	50.5%	17.9%	33.2%	36.2%
Mid bloom	32.6%	17.9%	38.0%	34.5%
Full bloom	15.8%	25.6%	18.3%	18.5%
Mature	1.1%	35.9%	10.5%	10.8%

Table 3. Reported hay harvest methods and storage procedures.

Type of Harvest	% of Total	% of Harvest Type
Large round bales	68.0	
Inside		20.6
Outside		
- no cover on soil		59.7
- wrapped on soil		12.5
- no cover on rock or pallet		2.8
- wrapped on rock or pallet		2.8
- other		1.6
Small square bales	29.8	
Inside		92.6
Outside		
- no cover on soil		5.6
- no cover on rock or pallet		1.9
Other Packages	2.2	
Inside		25.0
Outside		75.0

Table 4. Summary of wet chemistry analysis on 1994 forage survey.

	%	%	%	%	%	%	%	%	%	%	(ppm)	(ppm)	(ppm)	%	(ppm)	%	(ppm)	(ppm)		
	Protein	ADF	NDF	TDN	NE _m	NE _g	NEI	RFV	Ca	P	K	SE	Cu	Zn	S	Mg	Mn	Na	Fe	
Grass	<i>First Cutting, n=32</i>																			
Average	11.6	41.8	66.0	55.7	0.53	0.27	0.57	81.1	0.64%	0.24%	1.89%	0.268	10	25	0.17%	0.19%	81	0.01%	278	
Std Dev	3.1	4.1	6.9	4.3	0.07	0.06	0.05	17.8	0.31%	0.06%	0.40%	0.210	2	6	0.03%	0.05%	27	0.01%	224	
Max	20.7	50.1	75.2	67.4	0.70	0.44	0.70	167.7	1.64%	0.35%	2.68%	0.890	16	46	0.26%	0.34%	133	0.06%	1162	
Min	6.1	29.2	36.7	46.6	0.38	0.14	0.47	61.7	0.35%	0.12%	1.05%	0.080	7	16	0.10%	0.12%	34	0.00%	116	
Grass	<i>Other Cuttings, n=7</i>																			
Average	15.2	36.4	55.4	61.8	0.62	0.36	0.63	104.1	0.91%	0.32%	2.31%	0.39	11	28	0.21%	0.25%	89	0.02%	370	
Std Dev	2.5	4.3	8.4	4.8	0.07	0.06	0.05	20.2	0.25%	0.04%	0.61%	0.25	1	7	0.04%	0.04%	32	0.01%	249	
Max	19.7	40.5	68.6	69.7	0.74	0.46	0.72	138.2	1.21%	0.37%	3.06%	0.72	13	40	0.27%	0.33%	127	0.03%	928	
Min	12.1	29.3	44.5	57.2	0.55	0.30	0.58	77.7	0.57%	0.27%	1.15%	0.10	9	18	0.16%	0.19%	34	0.01%	219	
Grass-Legume	<i>First Cutting, n=100</i>																			
Average	13.9	40.7	61.4	56.1	0.53	0.28	0.57	88.7	0.99%	0.25%	1.96%	0.28	10	25	0.17%	0.24%	68	0.02%	293	
Std Dev	3.0	4.9	7.4	5.6	0.09	0.08	0.06	17.1	0.36%	0.05%	0.40%	0.19	2	5	0.04%	0.07%	31	0.01%	284	
Max	22.3	54.0	75.1	69.2	0.73	0.46	0.72	142.2	1.95%	0.45%	3.43%	1.00	20	41	0.29%	0.43%	188	0.06%	2001	
Min	8.0	29.2	43.3	41.0	0.29	0.05	0.40	63.4	0.29%	0.14%	1.07%	0.05	6	15	0.10%	0.10%	20	0.00%	81	
Grass-Legume	<i>Second Cutting, n=68</i>																			
Average	16.8	37.7	54.7	59.6	0.59	0.33	0.61	103.3	1.10%	0.31%	2.14%	0.34	10	26	0.20%	0.26%	61	0.02%	279	
Std Dev	2.7	4.8	6.5	5.5	0.08	0.08	0.06	18.2	0.23%	0.05%	0.40%	0.26	2	5	0.03%	0.05%	30	0.01%	292	
Max	22.3	48.5	68.6	69.7	0.74	0.46	0.72	157.5	1.62%	0.39%	3.21%	1.42	21	45	0.28%	0.41%	203	0.06%	1611	
Min	10.2	28.8	39.3	47.3	0.39	0.15	0.47	69.9	0.61%	0.19%	1.25%	0.05	7	15	0.12%	0.18%	23	0.00%	95	
Grass-Legume	<i>Third Cutting, n=52</i>																			
Average	18.3	35.2	51.1	62.4	0.63	0.37	0.64	115.3	1.17%	0.32%	2.14%	0.34	10	26	0.21%	0.28%	69	0.03%	278	
Std Dev	2.5	4.9	7.6	5.5	0.08	0.08	0.06	23.5	0.28%	0.05%	0.42%	0.21	2	5	0.03%	0.06%	35	0.02%	248	
Max	23.3	46.9	67.7	72.5	0.78	0.50	0.75	174.6	1.95%	0.45%	3.75%	1.00	16	41	0.29%	0.50%	225	0.08%	1406	
Min	10.9	26.3	35.3	49.1	0.42	0.18	0.49	73.6	0.66%	0.23%	1.31%	0.05	6	17	0.15%	0.17%	23	0.00%	88	

Table 4. Summary of wet chemistry analysis on 1994 forage survey.

Grass-Legume	Fourth Cutting, n=7																		
Average	19.8	31.0	43.9	67.2	0.70	0.43	0.70	138.8	1.32%	0.34%	2.30%	0.33	10	28	0.24%	0.31%	56	0.05%	209
Std Dev	1.4	3.5	4.7	3.9	0.06	0.05	0.04	17.3	0.29%	0.05%	0.46%	0.18	1	7	0.02%	0.04%	29	0.03%	44
Max	21.1	35.1	52.8	72.3	0.77	0.50	0.75	162.2	1.89%	0.43%	3.14%	0.71	12	37	0.27%	0.38%	118	0.09%	283
Min	17.3	26.5	39.1	62.5	0.63	0.37	0.64	113.1	0.97%	0.28%	1.71%	0.20	8	17	0.22%	0.24%	28	0.01%	158
Legume-Alfalfa/Clover	First Cutting, n=27																		
Average	16.9	39.3	54.5	56.7	0.54	0.29	0.58	101.5	1.50%	0.27%	2.25%	0.59	10	25	0.20%	0.27%	53	0.02%	335
Std Dev	2.6	4.9	6.2	5.2	0.08	0.07	0.06	18.6	0.43%	0.06%	0.45%	0.72	4	4	0.05%	0.05%	24	0.01%	188
Max	21.5	47.5	65.3	68.6	0.72	0.45	0.71	147.3	2.34%	0.42%	3.17%	3.50	26	39	0.30%	0.40%	142	0.04%	927
Min	10.8	28.1	42.3	47.9	0.40	0.16	0.48	74.2	0.71%	0.18%	1.45%	0.07	6	15	0.12%	0.20%	26	0.00%	110
Legume-Alfalfa/Clover	Second Cutting, n=32																		
Average	18.3	38.3	52.6	57.7	0.56	0.30	0.59	106.3	1.30%	0.30%	2.25%	0.48	10	25	0.21%	0.26%	52	0.02%	356
Std Dev	2.1	4.9	6.0	5.2	0.08	0.07	0.06	18.4	0.24%	0.04%	0.35%	0.52	2	5	0.04%	0.04%	19	0.01%	343
Max	21.8	50.4	64.9	67.7	0.71	0.44	0.70	147.6	2.09%	0.36%	3.17%	2.54	19	41	0.29%	0.36%	109	0.04%	1860
Min	13.8	28.9	41.8	45.1	0.36	0.12	0.45	73.9	0.92%	0.19%	1.47%	0.08	7	19	0.13%	0.20%	28	0.00%	119
Legume-Alfalfa/Clover	Third Cutting, n=33																		
Average	19.9	36.8	50.1	59.4	0.58	0.32	0.61	114.8	1.35%	0.31%	2.33%	0.44	10	24	0.23%	0.26%	53	0.03%	325
Std Dev	2.1	5.3	7.0	5.7	0.09	0.08	0.06	23.1	0.19%	0.03%	0.39%	0.45	6	4	0.04%	0.04%	19	0.02%	316
Max	23.3	48.0	62.6	69.5	0.73	0.46	0.72	170.3	1.69%	0.38%	3.27%	2.00	42	34	0.29%	0.35%	113	0.06%	1781
Min	13.4	27.2	37.0	47.3	0.39	0.15	0.47	79.7	0.81%	0.23%	1.57%	0.07	7	19	0.16%	0.19%	31	0.01%	111
Legume-Alfalfa/Clover	Fourth Cutting, n=4																		
Average	21.7	32.7	43.1	63.7	0.65	0.39	0.66	140.6	1.36%	0.33%	2.82%	0.26	10	27	0.27%	0.28%	55	0.02%	243
Std Dev	4.2	5.2	6.8	5.5	0.08	0.07	0.06	31.6	0.19%	0.05%	0.26%	0.14	2	5	0.06%	0.05%	11	0.01%	71
Max	25.2	37.8	50.7	69.1	0.73	0.46	0.72	182.7	1.53%	0.39%	3.08%	0.45	13	33	0.33%	0.33%	72	0.04%	339
Min	16.4	27.7	34.3	58.2	0.57	0.31	0.59	109.1	1.11%	0.28%	2.50%	0.12	9	22	0.20%	0.22%	46	0.01%	174

Table 5. Distribution of forage samples in meeting selenium and zinc requirements.

NRC Requirement Range			
Mineral	% Samples Below NRC	% Samples Meeting NRC	% Samples Exceeding NRC
Selenium	<u>Less than .1 ppm</u>	<u>.1 to .2 ppm</u>	<u>More than .2 ppm</u>
Grass Hay	15	33	52
Grass-Legume Hay	12	27	61
Legume: Alfalfa/Clover Hay	6	29	65
Zinc	<u>Less than 19 ppm</u>	<u>20 to 40 ppm</u>	<u>More than 40 ppm</u>
Grass Hay	13	85	2
Grass-Legume Hay	13	86	1
Legume: Alfalfa/Clover Hay	7	93	0

