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2010–2011 Beef Forage Summary—Cutting Dates and Quality Results

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Summary and Implications

Delayed harvest and subsequent advances in maturity decrease quality as does rain leached hay that has been cut. Both situations result in increased hay fiber content relative to available energy and protein. Quality of first cutting grasses tends to be more affected by advanced maturity. Legume or legume mixed forage may tend to have a greater quality reduction from rain leached windrows.

Introduction

Harvested forage quality is dependent on maturity and maturity generally follows the calendar or seasons. An excessive number of rain events, as was the case in the 2010 Iowa growing season forced many delays in harvest and also lead to many instances of rain leached forage nutrients from cut hay. Both situations can result in suboptimal animal performance due to more fiber (ADF and NDF) relative to the other nutrients and less available energy and protein if these forages are not supplemented. The purpose of this forage survey and article is to provide some idea of the impact this difficult harvest had on forage quality across the state of Iowa and provide some indication of the areas of supplementation that might be needed.

Material and Methods

Iowa producers submitted 465 forage samples for evaluation with Dairyland Laboratory of Arcadia, WI performing the analysis. A "basic" NIR analysis was conducted on all samples. Of the total samples; 144 were identified as grass (cool season), 185 were identified as a grass-legume mix, 65 were identified as legumes. Upon submitting these samples for NIR analysis a description of harvest date, cutting number and rain events influencing the cut forage was to be indicated by the producer. The effect of delayed harvest or rained on hay was summarized from producer data taken and paired with the NIR analysis of the forage.

Results

One point that the reader must keep in mind while viewing the results of this paper is that the data presented here was independent producer data and many of the descriptions describing the state of the forage was provided by the person providing the sample. This introduces inconsistencies both in the quantity and quality of data collected. Likewise, being that this is not a structured experiment, the ability to perform a meaningful regression on the data to describe the effect of rain, stage of maturity or cutting on forage quality in definite units of lost nutrient is diminished. What we are left with is a summary of what producers are using as forage in terms of average quality, a standard deviation of this quality and a range of what one may expect to find on farms.

Cutting

Table 1 indicates the effect of cutting versus quality. When viewing this data keep in mind that these values reflect all samples of the given plant classification and that time of first cutting or stage of maturity shown in the subsequent pages may have the primary impact. These results are not a reflection of a controlled harvest study where the same lot of forage is harvested at different times.

The grass cuttings showed the strongest cutting by time (maturity) interaction where the average stage of maturity in the first cutting was in the seed stage while the second and third cuttings were quite vegetative. To illustrate the interaction further, consider the mixed forage results. When grading maturity on a "1 to 6" scale of maturity where a "1" is vegetative and a "6" is dry seed heads the 1st cutting graded a "4.3", the second cutting graded a "3.6" and the third cutting a "3.1". Air temperature and moisture also have an effect on plant physiology, but these factors were not measured. An interesting issue appears where there appears a slight tendency for the later cuttings to have a slightly higher standard deviation or greater variability for the measured nutrients than what is observed in the first cutting. Quality tends to always be more favorable in the later cuttings and this is especially true when there is grass in the stand since after the first cutting, grass remains in a vegetative state.

Month That 1st Crop was Harvested and Forage Quality

Delayed cutting results in advanced plant maturity and the effect of advanced maturity is a decrease in energy availability, reduced crude protein and crude protein availability, increased fiber, slightly reduced Ca, increased Mg, reduced K and reduced NFC. This is the general trend, but not the rule. Considering the RFV (relative feed values), note that as harvest is delayed to the farthest dates there seems to be an upturn in quality. This delay does not improve the forage in itself, but what it does do is allow new growth to start and thus young, high quality forage

mixes in with the existing rank forage improving the forage that is cut and harvested. Table 2 deals with quality as affected by plant maturity due to delayed date in hay forage harvest.

When evaluating the second and third cutting the trends tend to become cluttered since the results of subsequent cuttings depend on when the prior cutting was taken. Therefore plant maturity still is the primary observable factor that indicates quality. The complete spectrum of plant maturity could not be illustrated in table 3 due to the samples that were obtained. The standard deviation observed may be partially due to natural variation in plants and the producer's interpretation of plant maturity.

A practical question then that must be addressed is whether it is better to delay cutting and accept advanced maturity in the forage to avoid a rain event. Table 4 outlines the results of the rain-on versus non rained on hay. These results are somewhat misleading if one wants to use these data to describe the effect of rain on forage since it seems that in many cases the rained on forage is the forage that was cut early and therefore significantly higher quality from the start. If this is the case though, the results tend to indicate that grass forage quality is affected more by maturity than rain leaching and should be cut with less regard to the weather. The forages mixed with legumes, however are less affected by maturity and seem to end up similar in RFV if cutting is delayed to miss a rainfall event.

Table 1-1. Energy, protein and fiber over first, second and third cuttings.

Grass 1st		TDN%	NE m Mcal/lb	NE g Mcal/lb	CP%	Adj. CP%	ADF%	NDF%
n=70	Avg.	55.09	0.49	0.24	10.34	9.99	43.95	64.33
	St.D.	3.84	0.03	0.03	2.61	2.60	4.15	5.43
Grass 2nd								
n=18	Avg.	57.37	0.51	0.26	12.56	12.35	40.45	60.34
	St.D.	4.46	0.03	0.03	2.69	2.69	5.56	7.41
Grass 3rd								
n=3	Avg.	61.62	0.52	0.27	14.03	13.91	37.80	57.06
	St.D.	1.89	0.03	0.03	0.89	0.69	2.97	0.37

Mixed 1st		TDN%	NE m Mcal/lb	NE g Mcal/lb	CP%	Adj. CP%	ADF%	NDF%
n=81	Avg.	54.62	0.49	0.24	12.95	12.56	43.78	61.13
	St.D.	4.12	0.04	0.04	2.77	2.79	5.09	6.50
Mixed 2nd								
n=38	Avg.	58.40	0.52	0.27	15.08	14.93	39.47	56.13
	St.D.	4.39	0.04	0.04	2.71	2.82	5.03	7.45
Mixed 3rd								
n=21	Avg.	59.14	0.54	0.28	16.33	15.76	38.75	53.35
	St.D.	4.19	0.05	0.05	2.96	2.71	5.63	8.38

Legume 1st		TDN%	NE m Mcal/lb	NE g Mcal/lb	CP%	Adj. CP%	ADF%	NDF%
n=23	Avg.	53.85	0.50	0.25	14.11	13.79	45.23	58.80
	St.D.	4.11	0.04	0.04	2.63	2.83	5.28	7.36
Legume 2nd								
n=8	Avg.	57.95	0.55	0.29	16.80	16.61	39.74	50.03
	St.D.	4.39	0.06	0.05	2.69	2.80	5.63	9.25
Legume 3rd								
n=11	Avg.	55.74	0.53	0.27	16.68	16.57	42.57	54.59
	St.D.	4.72	0.05	0.05	3.54	3.60	6.07	9.40

Table 1-2. Mineral , NFC and RFV over first, second and third cuttings.

Grass 1st		Ca	P	Mg	K	S	NFC	RFV
	Avg.	0.69	0.26	0.20	1.60	0.14	13.13	79.28
	St.D.	0.22	0.05	0.05	0.52	0.05	4.30	10.94
Grass 2nd								
	Avg.	0.75	0.29	0.23	1.94	0.19	14.89	90.53
	St.D.	0.23	0.04	0.06	0.36	0.06	5.06	18.02
Grass 3rd								
	Avg.	0.74	0.36	0.29	2.10	0.24	15.81	98.54
	St.D.	0.07	0.02	0.03	0.38	0.02	0.75	1.79
Mixed 1st		Ca	P	Mg	K	S	NFC	RFV
	Avg.	0.89	0.28	0.23	1.73	0.16	13.50	84.66
	St.D.	0.26	0.05	0.05	0.49	0.05	5.28	16.58
Mixed 2nd								
	Avg.	0.91	0.32	0.27	2.00	0.21	16.22	97.01
	St.D.	0.24	0.04	0.05	0.46	0.04	5.77	18.79
Mixed 3rd								
	Avg.	1.03	0.33	0.27	2.01	0.21	17.41	106.37
	St.D.	0.22	0.03	0.04	0.36	0.04	6.63	27.29
Legume 1st		Ca	P	Mg	K	S	NFC	RFV
	Avg.	1.11	0.29	0.24	1.90	0.15	14.45	87.17
	St.D.	0.24	0.03	0.04	0.42	0.04	5.66	18.94
Legume 2nd								
	Avg.	1.30	0.31	0.27	1.91	0.18	20.37	111.99
	St.D.	0.27	0.02	0.06	0.44	0.05	7.43	26.65
Legume 3rd								
	Avg.	1.14	0.33	0.25	2.02	0.21	16.09	98.61
	St.D.	0.31	0.05	0.05	0.51	0.05	6.55	23.64

Table 2-1. First cutting by month – energy, protein and fiber.

		TDN%	NE m Mcal/lb	NE g Mcal/lb	CP%	Adj. CP%	ADF%	NDF%
May	Avg.	59.55	0.54	0.29	15.41	15.29	38.60	53.91
n=19	St.D.	4.08	0.03	0.03	2.72	2.81	5.17	6.72
June	Avg.	54.72	0.49	0.24	11.74	11.34	44.21	62.21
n=41	St.D.	3.58	0.03	0.03	3.15	3.13	4.44	6.46
July	Avg.	54.20	0.49	0.23	11.01	10.65	44.67	63.84
n=43	St.D.	3.20	0.03	0.03	2.11	2.12	3.74	4.93
August	Avg.	53.03	0.48	0.23	11.22	10.84	45.85	64.98
n=33	St.D.	2.13	0.02	0.02	2.85	2.49	3.31	4.20
Later	Avg.	53.77	.047	0.22	9.83	9.05	47.01	67.80
n=6	St.D.	4.58	0.04	0.03	3.47	2.93	2.93	6.44

Table 2-2. First cutting by month – mineral, NFC and RFV.

		Ca%	P%	Mg%	K%	S%	NFC%	RFV
May	Avg.	0.98	0.32	0.26	2.11	0.19	18.21	104.78
	St.D.	0.30	0.04	0.05	0.50	0.06	4.99	20.73
June	Avg.	0.80	0.27	0.21	1.65	0.15	13.86	82.14
	St.D.	0.30	0.05	0.05	0.47	0.05	5.17	13.53
July	Avg.	0.78	0.26	0.21	1.64	0.14	12.98	78.70
	St.D.	0.29	0.04	0.05	0.43	0.03	4.22	8.87
August	Avg.	0.84	0.26	0.22	1.40	0.14	11.69	76.62
	St.D.	0.22	0.05	0.05	0.44	0.04	3.27	7.93
Later	Avg.	0.66	0.26	0.20	1.43	0.13	10.11	70.18
	St.D.	0.25	0.10	0.04	0.76	0.05	3.39	8.12

Table 2-3. Second cutting by month – energy, protein and fiber.

			TDN%	NE m Mcal/lb	NE g Mcal/lb	CP%	Adj. CP%	ADF%	NDF%
June		Avg.	60.50	0.54	0.28	14.41	14.74	37.52	52.61
n=	5	St.D.	4.38	0.06	0.05	2.59	2.89	4.65	8.13
July		Avg.	58.65	0.53	0.28	15.33	15.33	39.09	54.46
n=	29	St.D.	4.39	0.04	0.04	2.94	2.96	5.07	7.99
August		Avg.	57.10	0.51	0.26	14.11	13.83	40.76	59.25
n=	12	St.D.	3.61	0.05	0.04	3.52	3.49	4.42	9.07
Later		Avg.	59.37	0.51	0.26	11.68	11.28	37.91	58.66
n=	12	St.D.	3.47	0.02	0.02	1.24	1.50	4.46	4.94

Table 2-4. Second cutting by month – mineral, NFC and RFV.

			Ca%	P%	Mg%	K%	S%	NFC%	RFV
June		Avg.	0.92	0.31	0.27	1.95	0.20	19.94	106.76
n=	5	St.D.	0.29	0.03	0.05	0.46	0.05	5.67	25.50
July		Avg.	0.96	0.31	0.27	1.99	0.20	17.79	101.42
n=	29	St.D.	0.30	0.04	0.06	0.46	0.05	5.71	20.71
August		Avg.	0.90	0.32	0.27	1.99	0.20	14.05	92.72
n=	12	St.D.	0.39	0.06	0.06	0.36	0.05	6.45	21.76
Later		Avg.	0.76	0.27	0.26	1.61	0.18	17.44	95.08
n=	12	St.D.	0.17	0.03	0.03	0.34	0.03	4.88	12.99

Table 2-5. Third cutting by month – energy, protein and fiber.

			TDN%	NE m Mcal/lb	NE g Mcal/lb	CP%	Adj. CP%	ADF%	NDF%
July	2	Avg.	59.33	0.54	0.28	14.04	14.01	37.96	50.60
n=		St.D.	3.61	0.01	0.01	1.98	1.93	4.64	0.19
August	12	Avg.	58.70	0.54	0.28	17.03	16.44	38.70	52.89
n=		St.D.	5.19	0.06	0.05	3.19	2.86	6.21	8.67
Sept	6	Avg.	54.81	0.50	0.25	14.34	14.15	43.76	59.44
n=		St.D.	6.77	0.06	0.05	3.72	3.83	8.70	10.68
Later	12	Avg.	59.85	0.55	0.30	17.07	17.07	37.29	48.69
n=		St.D.	1.19	0.05	0.04	3.27	3.27	1.52	7.53

Table 2-6. Third cutting by month – mineral, NFC and RFV.

			Ca%	P%	Mg%	K%	S%	NFC%	RFV
July	2	Avg.	0.98	0.30	0.25	2.01	0.19	22.37	109.24
n=		St.D.	0.08	0.02	0.06	0.81	0.01	2.07	6.98
August	12	Avg.	1.03	0.34	0.28	2.06	0.23	17.20	107.77
n=		St.D.	0.23	0.04	0.04	0.42	0.04	6.74	30.77
Sept	6	Avg.	0.99	0.30	0.25	1.83	0.20	13.49	90.40
n=		St.D.	0.20	0.06	0.05	0.55	0.06	7.38	31.15
Later	12	Avg.	1.28	0.32	0.30	2.05	0.23	21.39	116.07
n=		St.D.	0.43	0.03	0.04	0.18	0.03	4.88	18.16

Table 3-1. Maturity of grass and energy, protein and fiber content.

Grass			TDN%	NE m Mcal/lb	NE g Mcal/lb	CP%	Adj. CP%	ADF%	NDF%
pre-boot		Avg.	57.52	0.52	0.27	12.70	12.41	40.28	58.80
n=	11	St.D.	1.93	0.02	0.02	2.45	2.38	2.48	3.18
boot		Avg.	55.85	0.49	0.24	10.82	10.52	43.11	63.29
n=	27	St.D.	3.02	0.03	0.03	2.11	2.22	3.87	4.40
dough		Avg.	55.19	0.49	0.23	10.37	10.17	43.80	64.43
n=	47	St.D.	4.94	0.03	0.03	2.87	2.83	5.34	6.58
dry/dead		Avg.	53.64	0.47	0.22	8.83	8.63	45.26	69.31
n=	2	St.D.	3.35	0.02	0.02	1.68	1.39	4.30	5.02

Table 3-2. Maturity of grass and mineral, NFC and RFV content.

Grass			Ca%	P%	Mg%	K%	S%	NFC%	RFV
pre-boot		Avg.	0.79	0.31	0.22	1.94	0.16	16.65	91.36
n=	11	St.D.	0.28	0.03	0.07	0.32	0.06	2.51	6.91
boot		Avg.	0.71	0.28	0.20	1.75	0.15	13.87	82.13
n=	27	St.D.	0.17	0.05	0.04	0.44	0.04	3.85	10.25
dough		Avg.	0.68	0.26	0.22	1.54	0.15	12.76	80.28
n=	47	St.D.	0.23	0.05	0.06	0.51	0.06	4.83	15.79
dry/dead		Avg.	0.54	0.23	0.15	1.30	0.13	10.11	72.30
n=	2	St.D.	0.11	0.00	0.04	0.48	0.01	3.43	9.50

Table 3-3. Maturity of mixed forage and energy, protein and fiber content.

Mixed Forage			TDN%	NE m Mcal/lb	NE g Mcal/lb	CP%	Adj. CP%	ADF%	NDF%
bud		Avg.	59.08	0.52	0.27	15.86	15.42	38.28	54.70
n=	9	St.D.	4.64	0.06	0.05	3.77	3.79	5.95	9.55
early flower		Avg.	59.29	0.53	0.28	15.39	14.94	38.37	53.85
n=	35	St.D.	4.35	0.04	0.04	3.06	2.99	5.56	7.42
late flower		Avg.	56.69	0.51	0.26	14.52	14.23	41.01	57.25
n=	52	St.D.	4.24	0.05	0.04	2.83	2.93	4.96	6.80
seed-dough		Avg.	52.98	0.48	0.23	11.83	11.50	46.07	65.13
n=	47	St.D.	2.43	0.02	0.02	2.09	2.04	3.12	3.10

Table 3-4. Maturity of mixed forage and mineral, NFC and RFV content.

Mixed Forage			Ca%	P%	Mg%	K%	S%	NFC%	RFV
bud		Avg.	0.98	0.30	0.26	2.08	0.21	16.70	104.47
n=	9	St.D.	0.30	0.07	0.04	0.61	0.05	6.52	26.07
early flower		Avg.	0.99	0.32	0.27	1.99	0.20	18.06	104.70
n=	35	St.D.	0.19	0.04	0.04	0.45	0.05	5.35	24.06
late flower		Avg.	0.95	0.31	0.25	1.96	0.19	15.59	93.36
n=	52	St.D.	0.27	0.05	0.05	0.44	0.05	5.83	17.21
seed-dough		Avg.	0.77	0.26	0.21	1.50	0.15	10.76	75.96
n=	47	St.D.	0.22	0.05	0.04	0.42	0.03	3.33	6.43

Table 4-1. Rain vs. no rain and energy, protein and fiber content.

grass		TDN%	NE m Mcal/lb	NE g Mcal/lb	CP%	Adj. CP%	ADF%	NDF%
76	no rain avg	55.51	49.19	24.00	10.81	10.69	43.24	63.79
6	some rain avg	55.23	49.63	24.41	10.47	10.10	43.23	64.02
11	heavy rain avg	56.38	50.11	24.85	12.62	12.48	41.74	61.64
mix								
89	no rain avg	56.34	50.73	25.42	13.94	13.56	41.64	58.23
15	some rain avg	54.65	48.86	23.68	14.88	14.31	43.82	59.68
30	heavy rain avg	57.21	51.48	26.11	13.77	13.73	41.42	58.64
legume								
28	no rain avg	55.68	52.47	27.01	15.85	15.75	42.93	54.87
3	some rain avg	57.66	53.74	28.19	17.16	16.86	40.11	51.73
4	heavy rain avg	54.04	51.88	26.48	14.62	14.21	44.76	56.73

Table 4-2. Rain vs. no rain and mineral, NFC and RFV content.

grass		Ca%	P%	Mg%	K%	S%	NFC%	RFV
76	no rain avg	0.69	0.27	0.20	1.71	0.15	13.34	81.39
6	some rain avg	0.74	0.26	0.21	1.57	0.13	13.83	81.69
11	heavy rain avg	0.73	0.28	0.24	1.62	0.18	13.62	87.67
mix								
89	no rain avg	0.93	0.29	0.24	1.86	0.18	15.38	92.73
15	some rain avg	1.03	0.31	0.26	1.81	0.16	12.50	86.88
30	heavy rain avg	0.81	0.30	0.25	1.80	0.19	15.04	89.78
legume								
28	no rain avg	1.17	0.31	0.26	1.93	0.18	16.57	97.24
3	some rain avg	1.48	0.29	0.29	1.61	0.21	18.42	108.10
4	heavy rain avg	1.16	0.29	0.25	1.79	0.14	16.30	94.63