2010-2011 Beef Forage Summary

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Summary and Implications

Forage is the most common and most variable input for beef production. NIR analysis allows a convenient means to evaluate the feedstuff input and facilitate balancing of an adequate ration. In years with extended periods of unfavorable harvest conditions, feed evaluation may be of more importance due to the greater chance of feed variability and reduced quality.

Introduction

Beef production is forage dependant and the value of forage is based on the beef it can produce. The variable component is the quality of the forage and this survey was performed to summarize what level of quality one could expect to find in the feed inventories of cow-calf producers across the state of Iowa. The summer of 2010 lead to some serious problems for producing higher quality forage. Excessive rain events from late May through August made production of dry hay very difficult. Therefore, cutting dates were delayed and plant maturity advanced leading to forage of higher fiber and reduced nutrient density. When cutting was not postponed the cut forage was often exposed to rain and therefore the more soluble and more energetic components such as plant sugars were leached away. The results of lower quality were then observed in the forage laboratory analysis and may have contributed to incidents of weak calf syndrome.

Material and Methods

One hundred seventy-one Iowa producers submitted 465 feed samples for evaluation with Dairyland Laboratory of Arcadia, WI performing the analysis. A “basic” NIR analysis was conducted on all samples with a small number of the samples also being evaluated by using the Combs-OARDC method and NDF digestibility. Of the total samples; 144 were identified as grass (cool season), 185 were identified as a grass-legume mix, 65 were identified as legumes, 25 as corn silage, 12 as corn stalks, eight as warm season (excluding corn) grass and seven as something other than these classifications. The remaining samples were not identified as to their plant make-up and were not included in this summary due to a lack of information.

Results

Table 1 provides a summary of all evaluated feedstuffs in terms of nutrient content. The data on this table is somewhat meaningless for balancing rations, but they do indicate the range of feed quality that producers do maintain as forages. Table 2 indicates how the actual forage species test out in nutrient content and will have more relevance towards what one may expect to find for a given class of feed. Table 3 provides a summary of what nutrient recommendations we need to fulfill for cows entering the herd and those that we want to maintain in the operation. Of the nutrients listed, non fiber carbohydrate (NFC) is the most variable relative to the mean. This is somewhat expected since this is the most volatile component contained in plants. The sugar content of forages contributes heavily to this fraction and it is this same fraction that is lost under suboptimal harvest and storage conditions. The energy components reflect this as well, but since energy is also derived from fiber, fat and protein the overall change in NE or TDN is lessened. Based on the range in NFC though, it is obvious that there are other feed components in this mix besides forages and corn silage is one such example since this feed is generally 50% grain.

Looking at Tables 1 and 3 simultaneously, if the average would indicate the actual average ration provided to cattle we would end up short on energy in many cases, marginal on metabolizable protein (MP) and a little short of phosphorus and sulfur. It is therefore evident that corn distillers grains which have become readily available due to the current ethanol industry over the last decade have a place in cow rations as a supplement since this feedstuff can fulfill these deficiencies quite well. Considering the samples taken over the course of this trial regarding net energy maintenance density (NEm), only 41% of these samples would be adequate for the mature cow which we would want to gain condition in the second trimester. Twenty four percent of the total samples would be adequate for mature cows in the third trimester. These percentages are less favorable for younger cows which also have a net energy gain requirement to maintain normal growth besides normal maintenance. The MP requirement versus what is available in the feed is a little difficult to estimate since the MP value is not static for a given ingredient, but rather changes based on the other ration components. More feedstuff crude protein generally leads to more MP though.

Table 1a. Overall summary of nutrient concentrations in feeds analyzed.

	DM%	TDN%	NEm Mcal/lb	NEg Mcal/lb	CP%	Adj. CP%	Prot_Sol%	ADF%	NDF%	Lignin%
Avg.	79.96	56.81	0.52	0.27	12.41	12.15	25.50	41.44	58.79	7.66
St.D.	16.07	6.04	0.08	0.07	3.99	3.82	9.69	7.80	10.60	1.35
min	7.46	42.84	0.41	0.16	3.97	2.72	5.00	9.12	14.47	5.04
max	95.85	82.15	0.90	0.61	28.91	22.14	87.25	59.13	83.75	10.43

	NFC%	Lipid%	Ash%	Ca%	P%	Mg%	K%	S%	RFV
Avg.	16.53	3.17	10.33	0.81	0.29	0.23	1.69	0.17	88.24
St.D.	9.73	2.13	2.17	0.34	0.08	0.05	0.54	0.08	21.06
min	0.07	1.73	4.85	0.05	0.13	0.10	0.37	0.02	54.82
max	69.19	12.13	15.84	1.67	1.10	0.40	2.95	0.95	215.10

Table 1b. Overall summary of nutrient concentrations in hay crops analyzed.

	DM%	TDN%	NEm Mcal/lb	NEg Mcal/lb	CP%	Adj. CP%	Prot_Sol%	ADF%	NDF%	Lignin%
Avg.	83.15	55.71	0.50	0.25	13.32	13.06	25.35	42.77	59.49	7.91
St.D.	11.72	4.73	0.05	0.04	3.20	3.20	8.31	5.76	7.77	1.72
min	27.44	42.84	0.41	0.16	4.03	4.00	5.00	21.36	31.22	5.04
max	94.71	72.26	0.68	0.41	22.47	22.14	59.18	59.13	77.59	10.43

	NFC%	Lipid%	Ash%	Ca%	P%	Mg%	K%	S%	RFV
Avg.	14.76	2.58	11.20	0.92	0.29	0.23	1.80	0.17	89.60
St.D.	5.91	0.52	1.73	0.25	0.05	0.05	0.47	0.05	20.93
min	0.07	1.82	5.96	0.12	0.13	0.10	0.51	0.04	54.82
max	34.04	3.94	15.84	1.67	0.43	0.36	2.95	0.33	215.10

*The TDN, NEm and NEg values listed here are the ADF derived values rather than the Combs-OARDC or NDF digestibility results.
*RFV = relative feed value

Forage Class and Nutrient Content

Table 2 breaks down each category of forage evaluated in terms of the observed nutrient content. The quality differences are somewhat due to actual plant characteristics, but also reflect weather conditions at harvest. Therefore delays caused by rain during the early summer of 2010 decreased values for some of the grass, legumes and mixed forage significantly and this is reflected in the higher fiber percent (ADF and NDF). This excessive fiber concentration can reduce dry matter intake and further complicate feeding since less intake will result in less caloric and MP intake of an already low nutrient dense feed.

Comparing forage analysis results to the animal nutrient requirements listed in Table 3, the grass samples on average would not support the MP requirement of the heifer or the lactating cow while the legume and legume mixes would or would be fairly close to covering the MP needs. The average results of grass alone would not be able to satisfy any of the energy requirements of the animals listed nor would the grass legume mixtures. The legumes would cover some of the lower end requirements as seen with a second trimester mature cow, but fail in most other cases. Considering the wide standard deviation of nutrients and the maximum values it is possible that the higher quality grasses, legumes or mixtures listed in the data base can accomplish the task of providing adequate energy and protein. This fact encourages the practice of producing high quality forage and protecting this forage after harvest. The average grass, legume and grass-legume mixtures can cover the mineral requirements of Ca, P, Mg, K and S fairly well across all classes though.

One issue that is not being addressed is the potential for feed sorting by the animal. This issue is of practical significance where feed is not forced to be consumed. When allowed to sort, as is often the case when large round bales are fed “free choice”, cattle tend to pick the better quality forage and exclude the rest. This situation can dramatically change the actual ration profile in a positive direction from what a forage test would indicate. However the trade off is the wasted feed that although may have some salvage value as bedding, generally is considered too high of economic loss to waste.

Table 2-1. Energy protein and fiber.

Grass		TDN%	NE m Mcal/lb	NE g Mcal/lb	CP%	Adj. CP%	Prot_Sol%	ADF %	NDF%
n=142	Avg.	55.47	0.49	0.24	10.78	10.60	21.21	43.45	63.75
	St.D.	4.21	0.04	0.03	2.98	2.95	9.57	4.74	6.40
	Min	45.04	0.41	0.16	4.03	4.00	5.00	30.77	46.03
	Max	64.93	0.59	0.33	20.78	20.78	59.18	56.30	77.59
Grass-Legume									
n= 183	Avg.	56.05	0.50	0.25	13.50	13.14	25.99	42.02	59.27
	St.D.	4.41	0.04	0.04	3.18	3.20	8.34	5.40	7.55
	Min	45.57	0.42	0.18	6.54	6.43	6.85	25.78	32.89
	Max	68.82	0.65	0.38	22.47	20.38	57.08	55.62	73.41
Legume									
n=65	Avg.	55.61	0.52	0.27	15.69	15.43	28.86	42.86	55.45
	St.D.	5.59	0.06	0.05	3.27	3.45	7.02	7.13	9.36
	Min	42.84	0.43	0.18	9.42	9.29	14.03	21.36	31.22
	Max	72.26	0.68	0.41	22.14	22.14	57.58	59.13	72.91
Corn Silage									
n=12	Avg.	69.74	0.73	0.45	7.79	7.70	34.89	25.70	40.06
	St.D.	4.53	0.06	0.05	1.33	1.38	8.60	5.83	7.34
	Min	51.59	0.46	0.21	5.49	5.49	16.72	18.30	29.73
	Max	75.03	0.77	0.49	12.56	12.39	49.05	47.89	65.93
Corn Stalks									
n=25	Avg.	53.00	0.60	0.34	5.43	5.13	33.68	49.78	72.11
	St.D.	0.03	0.03	0.02	1.25	1.76	20.52	3.65	6.23
	Min	50.00	0.56	0.30	3.97	2.72	22.08	41.94	64.20
	Max	58.00	0.64	0.38	8.63	8.60	87.25	54.51	83.75
Warm Season									
n=6	Avg.	56.00	0.49	0.24	9.69	9.46	22.06	47.18	67.33
	St.D.	0.05	0.04	0.03	5.75	6.13	15.80	3.94	8.24
	Min	51.00	0.44	0.19	4.79	4.76	8.06	41.30	57.34
	Max	62.00	0.52	0.26	19.25	19.11	45.81	53.00	77.99

Table 2-2. Mineral and carbohydrate.

Grass		Ca%	P%	Mg%	K%	S%	NFC%	Starch%	Sugar%
	Avg.	0.69	0.27	0.21	1.66	0.15	13.41	7.55	6.94
	St.D.	0.22	0.05	0.05	0.50	0.05	5.09	3.24	2.50
	Min	0.23	0.13	0.10	0.51	0.04	0.07	3.60	4.15
	Max	1.20	0.43	0.36	2.93	0.31	26.90	13.53	13.46
Grass-Legume									
	Avg.	0.89	0.29	0.24	1.81	0.17	14.71	3.88	7.06
	St.D.	0.26	0.05	0.05	0.47	0.05	5.62	1.93	3.23
	Min	0.12	0.17	0.13	0.80	0.06	0.26	2.68	1.71
	Max	1.53	0.41	0.35	2.95	0.33	32.06	7.31	14.58
Legume									
	Avg.	1.16	0.31	0.25	1.94	0.17	16.16		4.33
	St.D.	0.26	0.04	0.05	0.44	0.05	7.03		0.93
	Min	0.42	0.24	0.15	1.04	0.10	4.20		3.67
	Max	1.67	0.39	0.36	2.75	0.30	34.04		4.98
Corn Silage									
	Avg.	0.21	0.24	0.18	0.86	0.11	44.69	33.94	
	St.D.	0.12	0.02	0.03	0.18	0.01	9.08	7.28	
	Min	0.10	0.20	0.12	0.61	0.09	8.43	9.86	
	Max	0.75	0.28	0.24	1.59	0.14	55.87	44.70	
Corn Stalks									
	Avg.	0.30	0.18	0.18	0.66	0.10	15.13	8.33	
	St.D.	0.06	0.02	0.03	0.23	0.02	5.76	1.34	
	Min	0.25	0.15	0.15	0.37	0.07	3.74	6.68	
	Max	0.44	0.22	0.24	1.01	0.12	21.64	10.30	
Warm Season									
	Avg.	0.69	0.27	0.20	1.39	0.12	11.43	3.51	5.62
	St.D.	0.30	0.12	0.08	0.87	0.10	3.14		2.92
	Min	0.44	0.16	0.11	0.54	0.02	7.30		3.55
	Max	1.10	0.44	0.31	2.85	0.23	14.78		7.68

Table 3. Beef cow ration nutrient specifications for a number of production phases.

				Concentration in Ration at Estimated DMI							
		Gain	Est. DMI	NE m	NE g	MP	Ca	P	Mg	K	S
Animal	Wt.	lbs.	lbs.	Mcal/lb	Mcal/lb	%	%	%	%	%	%
Yearling Heifer	700	1.75	11	0.61	0.49	11.30	0.68	0.38	0.13	0.66	0.20
2nd Trimester – 1st calf	1050	0.75	15.4	0.70	0.10	7.50	0.47	0.27	0.19	0.95	0.28
3rd Trimester – 1st calf	1100	0.75	16.2	0.87	0.10	8.60	0.50	0.28	0.18	0.91	0.27
2nd Trimester – mature cow	1300	1	26	0.52	X	5.10	0.25	0.16	0.13	0.66	0.20
3rd Trimester – mature cow	1350	0	26.5	0.56	X	4.90	0.28	0.17	0.13	0.65	0.19
Early lactation	1350	0	30.5	0.69	X	8.20	0.37	0.23	0.19	0.66	0.17
Late Lactation + 1st Trim.	1275	0.25	27.5	0.68	X	7.00	0.33	0.20	0.21	0.73	0.19

*MP (metabolizable protein) is about equal to CP (crude protein) x 0.708 for rations composed of hay and low levels of grain.
*Requirements based on a spring calving, British –higher milk breed, with a 1350 lb mature body weight under Iowa weather conditions trying to gain ¼ of a body condition score during the second trimester.