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Beef Cattle Management Update

WHAT QUALITY FORAGE FOR WINTERING BEEF COWS?

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Beef cows are fed to maintain themselves and produce one live calf per year. This concept reflects a situation far simpler than it actually is in the field. Too simplistic an approach to feeding beef cows may lead to over-, or underfeeding. Both outcomes are detrimental to profits because one results in greater-than-required expenses, and the other results in less than optimum production. This means a cow/calf operator has a small margin of error to remain profitable; that should be reason enough to pay careful attention to detail, including forage quality.

The question is: what quality? Same as that for a dairy producer? Possibly not. Beef cows do survive on low quality feeds, as long as there is no need to support calf growth in her last trimester of gestation, lactation, or body weight recovery due to a "harsh" summer (improperly managed pastures, excessive milk production, late calving, or all of the above).

Forage Basics

Forages basically are structural components of plants that are fed to animals that have the ability to digest these structural components. Ruminants, such as beef cattle, have the ability to digest forages as a result of their relationship as hosts to rumen microbes. These microbes produce enzymes and have biochemical cycles that render forage useful primarily as energy and nitrogen sources.

Forage fiber components are cellulose, hemicellulose, lignin, pectin, cutin and silica. Cellulose and hemicellulose are digestible, while lignin, cutin and silica are not. Pectin is highly digestible but is not commonly found in many forages.

Some fiber fractions analyzed in the laboratory, or with near infrared reflectance spectroscopy (NIRS) are associated with digestibility and utilization of the plant. These are crude fiber (CF), neutral detergent fiber (NDF) and acid detergent fiber (ADF). Basically, these fractions were developed to identify fiber components and to determine the extent of their utilization by ruminants.

The crude fiber procedure was first developed in the late 1800's. However, because the procedure solubilizes some lignin, cellulose and hemicellulose, it underestimates the amount of cell wall components in the forage.

The NDF fraction is an estimate of the amount of total fiber (cell wall) in a forage. Comparing values in Table 1 demonstrates that NDF content is almost double the content of crude fiber. This difference reflects the extent to which forage fractions are lost (underestimated) in the crude fiber procedure. The NDF fraction is a good indicator of intake, because of its association with bulkiness of forages.

The ADF fraction measures cellulose and lignin of a forage. Because lignin is included in this fraction, it is associated with digestibility of the forage. Comparing values in Table 1 demonstrates that, for the same forage, ADF is normally 5 to 10 points greater than crude fiber (this fraction does not underestimate cellulose and lignin as the crude fiber fraction), and smaller than NDF (ADF eliminates hemicellulose).

Another observation of interest in Table 1 is that the difference between ADF and NDF is greater in grasses than in legumes; therefore, grasses contain more hemicellulose than legumes. For legumes, the difference between ADF and NDF is about 10 points; while for grasses, it is closer to 20 points.

Fiber fractions are negatively associated with energy values of forages and feedstuffs, because it is assumed that, as more fiber occupies spaces in cells, less soluble (readily digestible) cell components can be present. This is the case with mature forages. In Table 1, late vegetative brome contains 35% ADF; its energy (TDN) content is 60%. Late bloom brome and hay contains 43% ADF; its TDN content is 55%. A difference of 8 percentage points in fiber reflects a difference of 5 points in energy content. A 1200-lb cow in her last trimester of gestation would obtain sufficient energy for maintenance from the immature, but not the mature brome.

Implications

A simplified strategy table (Table 2) was developed to aid in integrating concepts discussed thus far. Because winter feeding cows represents feeding them through at least the last trimester of gestation, the standard cow utilized to generate this table weighed 1200 lb and was in her last trimester of gestation. The minimum quality forage this cow can afford to consume to maintain herself, and to support gestation, is a forage (hay or silage) with 7.6% crude protein, and 56% TDN (NRC, 1984). Based on equations that relate TDN and fiber content of forages, maximum ADF concentration in this forage should be 42% if it is grass or legume hay, or 45% if it is corn silage. Supplemented energy was provided with dry rolled corn grain ($2.50/bu) while supplemented protein was provided by 44% soybean meal ($240/ton) to simulate feeding hay or silage of lower quality than the quality required. From this simulation, amount and cost of protein or energy supplementation was calculated.

Values from this table indicate that one percentage unit drop in TDN below 55%, regardless of whether hay or silage is used, results in a need to supplement with approximately .5 lb of dry rolled corn. Similarly, one percentage unit drop in CP results in a need to supplement with approximately .5 lb of soybean meal. Similar results were obtained with other standardized cow weights used (up to 1400 lb).

Because energy values of soybean meal and corn grain are similar, supplementation for a hay with both energy and protein lower than required can be considered additive. Thus, to supplement a hay with 53% TDN (46% ADF), and 5.6% CP, the supplement could be approximated to 2 lb of corn and 1 lb of soybean meal/cow/day; $20.52/cow/last trimester of gestation.

Another way of using Table 2 is to say that for grass or legume hays, every percentage unit increase in ADF over 44% represents a $1/ton increase in the balanced diet and every decrease in CP below 7.6% of one percentage unit represents a $4/ton increase in the balanced diet. For silages, every increase in ADF over 47% represents a $.50/ton increase in the balanced diet while every decrease in CP below 7.6% of one percentage unit represents a $2/ton increase in the balanced diet.

Table 2 may be used as a guide when purchasing forages, or when analyzing forages harvested from the farm to identify needs for supplementation during winter feeding. Also, the table is depicted to relate importance of forage quality and winter feeding costs; thus, it may be utilized to aid in determining price of winter forages knowing only fiber and protein contents. However, this table assumes that cows require no weight gain to calve in greater body condition. When body weight gain is required, greater TDN requirements will be needed. Supplementation of winter forage may be necessary, even at 56% TDN.

Table 1. Fiber, energy and protein contents of various forages and feedstuffs.

Feedstuff	DM, %	CF	ADF	NDF	TDN	CP
Minnesota samples		------------------------------	------------------------------	% DM	------------------------------	------------------------------
Hay						
legume			38.0	50.7	59.3	18.0
legume-grass			39.3	55.4	58.3	15.6
grass-legume			40.4	59.2	57.4	13.6
grass			40.4	63.7	57.4	10.3
Hay-crop silage						
legume			39.2	46.7	58.4	19.0
legume-grass			40.8	50.5	57.1	16.5
grass-legume			39.3	53.5	58.3	14.6
grass			42.8	57.4	55.6	13.1
Corn silage						
normal			28.0	47.7	68.2	8.0
sweet			36.0	59.0	62.6	8.0
popcorn			32.0	51.0	65.4	9.0
stover			39.0	67.0	60.5	6.0
NRC, 1984						
Barley						
grain	88.0	5.7	7.0	19.0	84.0	13.5
hay	87.0	27.5	-	-	56.0	8.7
straw	91.0	42.0	49.0	80.0	40.0	4.3
Beet pulp, dehy.	91.0	19.8	33.0	54.0	74.0	9.8
Brome hay						
late vegetative	88.0	30.0	35.0	65.0	60.0	16.0
late bloom	89.0	37.0	43.0	68.0	55.0	10.0
Canarygrass, hay	91.0	33.0	30.0	64.0	55.0	10.3
Corn plant						
stover	85.0	34.4	39.0	67.0	50.0	6.6
silage, well eared	33.0	23.7	28.0	51.0	70.0	8.1
silage, few ears	29.0	32.3	-	-	62.0	8.4
silage, no ears	31.0	31.3	35.0	68.0	55.0	6.3
Corn grain						
dry rolled	89.0	-	3.0	9.0	88.0	10.0
high moisture grain	70.0	-	4.3	11.2	89.0	10.6
high moisture ear	66.7	-	10.2	16.6	79.3	9.3
snaplage	44.0	-	14.0	42.5	74.0	8.9
gluten feed	90.0	9.7	-	-	83.0	25.6
Orchard hay						
early bloom	89.0	31.0	34.0	61.0	65.0	15.0
late bloom	91.0	37.1	45.0	72.0	54.0	8.4
Prairie hay	92.0	34.0	-	-	51.0	5.8
Timothy hay, full bloom	89.0	32.0	38.0	68.0	56.0	8.1

Table 2. Amount and cost of energy or protein supplementation when hay or silage used in winter feeding is below requirements.

Feedstuff	DM	CP	ADF	TDN	lb supp.	$/cow/ day	$/ton balanced diet[a]	Additional $/ton[a,b]
Hays	89	7.6	42	56	0.0	0.000	40	0.0
	89	7.6	44	55	1.1	0.050	42.4	2.4
	89	7.6	45	54	1.6	0.073	43.5	3.5
	89	7.6	46	53	2.1	0.097	44.6	4.6
	89	7.6	47	52	2.6	0.120	45.8	5.8
	89	7.6	49	51	3.1	0.140	46.9	6.9
	89	6.6	42	56	0.6	0.067	44.7	4.7
	89	5.6	42	56	1.1	0.128	49.0	9.0
	89	4.6	42	56	1.6	0.189	53.3	13.3
Silages	30	7.6	45	56	0.0	0.000	18.0	0.0
	30	7.6	47	55	1.1	0.050	19.2	1.2
	30	7.6	48	54	1.6	0.073	19.8	1.8
	30	7.6	50	53	2.1	0.097	20.4	2.4
	30	7.6	51	52	2.6	0.120	21.0	3.0
	30	7.6	53	51	3.1	0.140	21.6	3.6
	30	6.6	45	56	0.6	0.067	19.8	1.8
	30	5.6	45	56	1.1	0.128	21.5	3.5
	30	4.6	45	56	1.6	0.189	23.2	5.2

[a] Hay at $40/ton supplemented with corn ($2.5/bu) or soybean meal ($240/ton) when required.

[b] Relative to hay at $40/ton containing at least 56% TDN and 7.6% CP.