Evaluating Forage Protein Before & After Calving Season

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Roughage fed to cows during the winter is the primary source of dietary protein. Most roughage sources contain ample carbohydrate energy within their fiber cells to meet animal nutrient requirements. However, roughages with low-protein concentrations can be difficult for ruminants to digest. The microbes within the rumen break down the fiber cells of the roughage, allowing for the extraction of carbohydrate energy. These microbes, however, cannot use carbohydrates as food. Microbes require protein (aka: nitrogen) as their primary food source. When roughage is low on protein and high in fiber, the microbes within the rumen simply do not have enough food to function and reproduce efficiently. Therefore, digestion of the roughage within the rumen slows down considerably. When adequate roughage protein is available or is supplemented through alternative high-protein feeds, ample carbohydrate energy can be extracted from even the most fibrous, low-quality roughages with relatively high efficiency. Thus, dietary protein is the key nutrient ruminants need to digest roughage.

How much protein does a beef cow need? The first criteria to determine protein needs is cow size. Bigger animals need more total protein. Since bigger animals eat more, their diet protein concentration is less than smaller animals. The second criteria is cow production stage (Table 1). Protein requirements increase as pregnancy progresses and peaks during lactation; about a month after calving.

Table 1. Apx. CP concentration (% of daily diet) to meet nutrient requirements based on cow size (lbs BW) and production stage.

	Cow Production Stage		
Cow Size (lbs)	2nd trimester (%)	3rd trimester (%)	Lactation (%)
1,200	7.1	7.9	10.5
1,300	7.1	7.9	10.3
1,400	7.5	8.5	10.1
1,500	7.5	8.5	9.8

Table 2. Example assuming we are feeding 30% corn silage, 60% corn stover, and 10% corn grain.

A	B	C	D	E	F	G	H
Feed ingredient	Formula	% CP (dry basis)	Moisture	Amount fed (DM) *Intake x B*	Amount fed (in the bunk) *E/(100 – D)*	Total protein consumed *E x C*	Protein concentration in diet *G/Intake*
Corn Silage	30%	6%	65%	35 x .3 = 10.5 lbs	10.5/.35 = 30 lbs	10.5 x .06 = 0.63 lbs	
Corn Stover	60%	4%	15%	35 x .6 = 21.0 lbs	21.0/.85 = 25 lbs	21.0 x .04 = 0.84 lbs	
Corn Grain	10%	9.5%	10%	35 x .1 = 3.5 lbs	3.5/.9 = 4 lbs	3.5 x .095 = 0.33 lbs	
Diet Total						0.63 + 0.84 + 0.33 = 1.8 lbs	1.8/35 = .05 or 5%

Calculating dietary crude protein (CP) in the daily diet is key to making sure cattle are getting the feed to meet their needs. There are two components to formulating diets: intake (are they eating enough) and formulation (are they getting the right nutrients). A gestating beef cow eats ~2% of her body weight (BW) in dry matter (DM) per day. If we take her BW, 1,400 lbs X .02, she is going to eat ~28 lbs of DM feed per day. Once she has calved and starts lactating, she will eat ≤2.5% of her BW per day, maybe more if it is really cold. Now, we can calculate how much protein she is getting. If fed a grass hay testing at 9% CP, take 28 lbs x .09 = 2.52 lbs of CP. To calculate protein, take pounds of CP and divide by total amount of feed eaten (2.52/28 = .09). The CP concentration is 9%. Roughage is great for cows before calving, but after, use a better-quality roughage or feed a protein supplement (Table 1). This example is easy since we were using one feed ingredient. Let's look at a more complex diet. Assume a 1,400 lb cow that is lactating (1,400 lbs x .025 = 35 lbs DM daily). In Table 2, on the surface it seems as though we are feeding a nice diet, but in reality it is only ~5% protein, largely due to corn stover. So, replace some of the stover with a higher protein roughage or feed a supplemental protein.

Table 3. Apx. CP concentration (% of daily diet) to meet nutrient requirements based on bred heifer size (lbs body weight) and production stage.

	Bred Heifer Production Stage		
Bred Heifer Size	2nd trimester (%)	3rd trimester (%)	Lactation (%)
950 lbs	10.5	10.3	12.1
1,050 lbs	9.5	9.8	11.9
1,150 lbs	9.0	9.6	11.5

Table 4. Apx. cost per lb of CP of different supplemental protein sources.

A	B	C	D	E
Ingredient	CP (%)	Retail cost ($/Ton)*	Total CP (lbs) *2,000 lbs x B*	Cost per lb of CP ($/lb) *C/D*
Mixed grass-legume	14	90	280	$0.32
Alfalfa	18	110	360	$0.30
Soybean meal	44	305	880	$0.34
Dried distillers grain	30	130	600	$0.21
Canola meal	35	235	700	$0.33
Range cake	20	250	400	$0.62
Lick tub	20	900	400	$2.25

*Does not include shipping and handling costs; based on 10/26/18 retail price.

Feeding a bred heifer uses the same concept, except protein requirements will be higher because not only is she growing a calf and milking, she is still growing herself. Table 3 shows the protein requirements of bred heifers.

When supplementing protein in your winter rations, which is more practical for some than buying better-quality hay, keep in mind not all proteins cost the same. Table 4 shows the cost per pound of CP in different supplemental protein sources.

Finally, it is important to test feed for quality. A good resource is: extensionpublications.unl.edu/assets/html/g331/build/g331.htm.