Beef Cattle Myth Buster

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Is it true that very low quality forages are only "fillers" in beef cow diets?

Low-quality forages

First, let's define what a low-quality forage (roughage) is: In the beef cow world, we consider low-quality as being less than 7% crude protein. The reasoning behind this is that with low-quality forages, protein is the first limiting nutrient. That means without protein in sufficient amounts to meet the cows' (and rumen microbes') requirement for nitrogen (supplied by the crude protein), maximum or even optimum productivity can't be expected even if all of the other nutrients are available in adequate amounts. Some examples of low-quality forages available to beef cattle producers in the Pacific Northwest are wheat straw (and other small grain straw, 3-4% crude protein [CP]), bluegrass straw (6% CP), and dormant cool season grasses (5-6% CP) just to name a few. We typically focus our attention to low-quality forages when the cows' nutrient requirements are relatively low such as in the fall/winter for spring-calving cows.

So why do we want to feed low quality forages in the first place? The main reason is that they can be purchased at a relatively reasonable price and with the high proportion of the annual costs for beef cattle producers in the Pacific Northwest going for feed, it is a great way to manage the feed bill and support profitability.

There is an inexorable link between protein and energy in our forages. This goes back to the idea of the protein being the first-limiting nutrient. The rumen microbes need nitrogen which is ultimately used to make microbial protein. This is particularly important because a cow's metabolizable protein requirement is met by two sources, microbial protein as the rumen microbes die off and enter the small intestine, and bypass (ruminally undegradable) protein that escapes rumen degradation and finds it way to the small intestine for digestion and absorption. The bottom line is, with low-quality forages, it is important that feeding programs are meeting the rumen microbe's requirement for protein by supplementation. When we supplement protein, our goal is to meet the rumen microbe's nitrogen requirement so that the microbes can maximize their degradation of fibrous feed in the rumen. In doing so, increases in intake and/or digestibility will result in delivery of more energy to the cow and productivity by whatever measurement you are evaluating (i.e. weight gain, increased body condition scores, conception rates, etc.).

There is a common misconception that low-quality forages have little feed value. Think about the ability of wild grazing ruminants like bison and elk to survive and thrive. If adequate low-quality grass is available in the winter, they do quite well. Ruminants are well adapted to harsh conditions.

On this issue of "fillers"

The following table illustrates dealing with the common misconceptions of the feeding value of low-quality forages (Table 1). Let's take a look at the similarities and differences.

Table 1. Comparison of nutritional chemical composition of alfalfa hay and wheat straw

	Forage/Feed[1]	
Composition	Alfalfa Hay[2]	Wheat Straw
	---------- Percent (%) ----------	
Dry Matter	100	100
Crude Protein (CP)	20.0	3.5
Ruminally degradable protein	13.9	1.1
Available fiber	18.7	31.9
Neutral detergent fiber (NDF)	40.0	73.7
Total digestible nutrients (TDN)	66.0	43.1
Microbial CP potential	10.0	8.0
	----------Mcal/kg----------	
Gross energy (GE)[3]	4.1	3.9
	---------- Mcal/kg ----------	
Metabolizable energy (ME)	2.2	1.5
Net energy for maintenance $(\mathrm{NE_m})$	1.5	0.68
Net energy for gain $(\mathrm{NE_g})$	0.91	0.11

[1]Adapted from NRC Nutrient Requirements of Beef Cattle, 2000, and 2016, and Rohwer, 2021 unpublished data.

[2]Mid-bloom

[3] Hossein Janmohammadi et al., 2014

We can all agree that alfalfa and wheat straw are pretty much on opposite ends of the spectrum when it comes to forage quality. Let's discuss how we might evaluate the use of wheat straw in a low-cost cow diet for winter feeding. First consider gross energy (which is in simple terms, the heat of combustion). In other words, if we were to combust equal amounts of alfalfa and wheat straw, they would liberate roughly the same amount of heat (4.1 Mcal/kg vs 3.9 Mcal/kg, respectively). So why is alfalfa considered a better feed if they both contain relatively equal amounts of energy? In one word, utilization. When all of the various losses during digestion are accounted for, more nutrition per unit fed is retained in the cow that is fed alfalfa. Alfalfa hay is quite rich in crude protein (our example in Table 1, 20%) and therefore is one of our classic protein supplements in the Pacific Northwest. On the other hand, wheat straw is very low in quality as measured by crude protein (3.5%; remember that protein is the first limiting nutrient with low quality forages). A measure of fiber, Neutral Detergent Fiber (NDF), is lower in the alfalfa (which indicates higher quality) and is quite high in wheat straw (higher NDF is related to reduced intake by the animal). The degradability of the protein (RDP/DIP) in alfalfa is much higher than from wheat straw meaning that it would be better in supplying nitrogen to the rumen microbes. Total Digestible Nutrients (TDN), one of our long-standing energy systems, suggests that the digestibility is about 66% and 43% for alfalfa and wheat straw, respectively. Many folks find it hard to reconcile the fact that so much of the feed actually comes right out the back end of the cow as undigested material. There are two reasons why we don't just feed alfalfa: 1) it is usually expensive, and 2) doing so would overfeed protein which would be wasteful, and the nitrogen excreted would not be beneficial to the environment.

After all energy losses are accounted for in digestion and utilization of feed, we arrive at Net Energy for Maintenance (NE_m, Table 1). Notice that the NE_m for alfalfa and wheat straw is 1.5 Mcal/kg and 0.71 Mcal/kg of feed, respectively. This tells us that it takes 2.1 lbs of wheat straw to equal 1 lb of alfalfa to maintain the cow. While this ratio may seem quite large, it also says that it is possible to make good use of wheat straw. It is also important to note that wheat straw can support up to about 8% equivalent protein supplementation from non-protein nitrogen (NPN) sources such as urea without concern about urea toxicity. Supplementation of crude protein beyond what is required to provide 8% crude protein in the diet will require natural protein sources such as efficient amounts of alfalfa hay, distiller's grains, and/or oilseed meals.

Taken together, low-quality feeds like wheat straw do have their place in beef cow feeding programs if used appropriately. When producers want to feed roughages like wheat straw, they need to apply feeding strategies to enhance forage utilization. As noted earlier, feeding supplemental protein in the form of alfalfa hay or byproduct feeds such as oilseed meals and distiller's grains can be effective in correcting for the protein deficit. It is also important to note that when feeding low-quality forages like wheat straw that provision of a Ca and P based self-fed mineral supplement is essential to provide to the cows to ensure their feeding program is in balance for all essential nutrients. There are a host of commodities and forms of protein supplements that producers can use in beef cattle operations (that is a discussion for another day). In fact, small amounts of supplemental protein can be very efficient in enhancing the ability of the rumen microbes to degrade roughage in the rumen. In doing so it is common to see increases in intake and/or digestion, which in turn delivers more energy to the cow. In other words, the base forage is better utilized and the benefit is much greater than achieved from the supplement alone. Anything that can be done to enhance forage utilization, such as when providing supplemental protein to meet the requirement, but not overfeed is money in the pocket of producers.

There you have it; the myth is busted! Low-quality forages are more than just "fillers", are relatively inexpensive and when supplemented appropriately, can deliver sufficient energy to the cow to meet production goals.