Producing Quality Hay

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In parts of the state many producers have harvested their first cutting of hay and have or will be getting ready to harvest their second cutting. However, many other parts of the state have not received sufficient rainfall to produce any hay and in these areas many producers are looking to purchase hay. Regardless of which one of these situations applies to you, understanding some of the basic factors affecting hay quality is important. Hopefully, your goal is to produce or purchase high quality hay that will reduce or better yet eliminate the need for additional protein and energy supplementation from grain and other concentrates.

When evaluating hay for beef cattle many components should be considered including, but not limited to crude protein concentration (CP), an estimate of energy content or digestibility (i.e. TDN, NEm, NEg, in vitro digestibility, etc.; TDN = total digestible nutrients), mineral concentration, palatability, and factors related to storage losses (i.e. bale size, bale shape, bale density, forage species, etc.). Because CP and TDN represent two major nutritional requirements of beef cattle, we will focus on how various agronomic and environmental factors affect CP and TDN concentration of hay and the amount of CP and TDN required by different classes of beef cows to maintain body weight under typical production conditions (see Table 1).

In Texas, it is common to see hay for sale advertised as "well-fertilized". What does "well-fertilized" truly tell us about hay quality? Unfortunately, saying hay was "fertilized or well-fertilized" tells us very little about hay quality and its feeding value for beef cattle. To understand why "fertilized" does not tell us very much about hay quality, let's consider the effect that nitrogen fertilizer has on hay yield and quality. Assuming other plant nutrients are adequate and that forage maturity is the same, then increasing the amount of nitrogen fertilizer will typically increase forage yield as well as CP concentration in the forage. However, nitrogen fertilizer has very little if any effect on TDN concentration (see Table 2).

When analyzing hay quality many people focus solely on the CP concentration of the hay, but this is not a good idea. Both CP and TDN should be considered when evaluating hay because a high CP content does not always correspond to a high TDN content. Additionally, a high TDN content does not always correspond to a high CP content. There are several reasons why this could occur. One of these reasons is that if hay is rained on after cutting but before baling, an increase in CP concentration and a decrease in TDN concentration is generally observed. This happens because some of the soluble carbohydrates are washed out of the hay thereby increasing the concentration of the remaining components such as CP.

One of the biggest factors affecting forage digestibility and thus TDN concentration is plant maturity. As plants increase in maturity, lignin and fiber (plant structural components) concentrations increase and forage digestibility decreases. This results in both a decrease in TDN and CP concentration. To optimize both forage quality and forage yield it is commonly

recommended that forages such as bermudagrass be harvested every 3 to 5 weeks and that forages such as sundangrass and sorghum x sudangrass hybrids be harvested before mature seed head production.

Another factor that has a major impact on forage quality of warm season grasses is temperature. As temperature increases, lignin deposition in the plant increases which in turn decreases forage digestibility. Lignin is the single most important factor affecting forage digestibility and utilization by ruminants. Remember, as lignin increases forage digestibility decreases. Because of this relationship between temperature and lignin deposition in warm season grasses, hay harvested in the spring and fall will typically be more digestible and have a higher TDN concentration than hay harvested during mid-summer.

A basic understanding of how these four factors affect hay quality and a basic knowledge of the amount of CP and TDN required by beef cows should help you be more effective in producing and purchasing high quality hay. However, a basic understanding of these factors is not a substitute for sending a hay sample to a good forage lab for analysis of crude protein and TDN content. Remember that producing or purchasing quality hay that meets or slightly exceeds the needs of your cows for protein and energy will eliminate the need for additional, costly protein and energy supplementation.

Table 1. Estimated CP and TDN requirements of cows at various stages of production*

Cow Stage of Production	CP, % of dry matter	TDN, % of dry matter
2-yr-old lactating cow	11	62
3-yr-old lactating cow	11.5	63
mature lactating cow, 25 lbs of milk	11.5	63
mature lactating cow, 15 lbs of milk	10	60
mature dry cow, 270 d pregnant	8	55
mature dry cow, 180 d pregnant	7	49

*Estimated dietary requirements to maintain cow body condition for Brahman influenced cows under typical production conditions (Beef Cattle NRC, 1996). These requirements will vary depending on numerous factors including animal weight, body condition, breed, environmental factors, and others.

Table 2. Typical effect of various agronomic and environmental factors on CP and TDN concentration in hay

Agronomic/Environmental Factor	% CP	% TDN
increased amount of nitrogen fertilizer	increase	minimal effect
hay rained on after cutting but before baling	increase	decrease
increased plant maturity	decrease	decrease
increased temperature during growth of warm season grasses	minimal effect	decrease