Managing Forages to Meet Beef Cattle Nutrient Needs

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Summary

The most cost-effective way to meet beef cattle nutritional needs is generally to ensure that the forage provided to the animals approaches or exceeds the nutrient needs of the cattle being fed. The challenge is consistently producing forages that provide sufficient protein, energy, and mineral content. Management factors, such as the forage crop's maturity and the species of the forage provided to the animal, has a significant impact on the crude protein, digestible energy content, and mineral concentration. This paper describes some of the management factors that influence the nutritive value and mineral content of forage.

Background

In most beef cattle enterprises, 60 percent or more of the total cost of production is tied up in feed costs. The forage component consists of the largest proportion of that cost. The use of forages that approach or exceed the nutrient needs of the cattle being fed will minimize the total cost and increase profitability. The challenge is consistently producing forages that provide sufficient protein, energy, and mineral content. This article discusses some of the management factors that influence forage quality and mineral content.

Discussion

Management Factors That Affect Forage Quality

The most critical management factors and their relative importance with regard to forage quality are listed in Table 1. Certainly, there are many additional factors that affect forage quality. However, following the recommendations for each

Table 1. The relative importance of the primary factors that affect the nutritive quality of forage and general recommendations on best management practices that optimize quality.

Importance	Factor	Recommendations
High	Forage Maturity	Cut the forage in the late vegetative or early reproductive stages of growth. See the harvest recommendations in **Table 2** for detailed information on individual species.
High	Forage Species	Use a high quality forage species that persists and can be produced economically in your environment. Species resistant to drought and temperature extremes should be used.
Moderate	Forage Utilization	Grazed forage is generally higher quality than conserved forage (i.e., barn, hay silage, etc.) However, animal selectivity may reduce overall forage utilization compared to mechanically harvested systems.
Moderate	Variety	Use varieties that have proven to provide a good balance of high quality and high yields. Select disease and insect resistant varieties.
Moderate	Storage	Protect hay bales from rainfall and weathering during storage (i.e., barn, tarp, etc.). Properly pack and exclude oxygen from forage that is being ensiled.
Moderate	Rain Damage	Avoid cutting if significant rainfall (> 0.50 inches) is predicted during curing, but take care to avoid allowing forage to become overly mature.
Moderate	Heat Damage	Dry forage to the appropriate moisture for making hay (Round: 15%; Square: 18%) and store in a manner that allows adequate ventilation. Maintain integrity of oxygen barrier in silage storage.
Low	Fertilization	Fertilize based on soil test recommendations and at recommended times to sustain CP/mineral concentrations in the forage and to maximize vegetative mass in the standing forage.

of these factors will help cattlemen to harvest high quality forage that optimizes yield.

Forage Maturity

Maturity is the most important factor affecting forage quality. Young, leafy vegetative growth has a higher level of digestible nutrients and protein, which declines as the plants progress toward maturity. One example of this is provided in **Figure 1**. Older forage has fewer leaves, more stems, and a higher fiber (NDF) content. As plants mature, more lignin is deposited. Lignin gives the plant strength and rigidity. Lignin also is a natural chemical barrier that plants use to protect themselves from attack by bacteria, fungi, and insects. The mechanism that the plant uses to provide this protection also means the forage is protected against digestion. Therefore, lignin causes the forage to be much less digestible and less capable of meeting the energy needs of the animal. Even though more total DM yield accumulates with advancing forage maturityfrom vegetative to against digestion. Therefore, lignin causes the forage to be much less digestible and less capable of meeting the energy needs of the animal. Even though more total DM yield accumulates with advancing forage maturity from vegetative to reproductive stage of growth, there is a point where the amount of digestible dry matter harvested per acre (digestible yield) no longer increases. **Figure 2** highlights this phenomenon in tall fescue, but all forage crops exhibit this same relationship.

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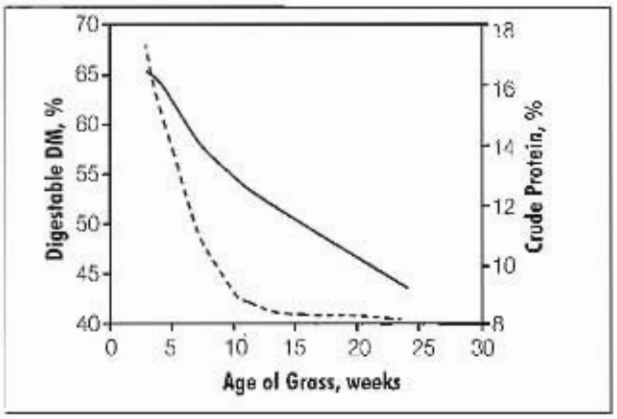

Figure 1. The digestable dry matter (DDM) and crude protein (CP) of Coastal bermuda grass as affected by plant maturity in South Georgia.

Source: Burton et al., 1963. Argon. J. Costal Plain

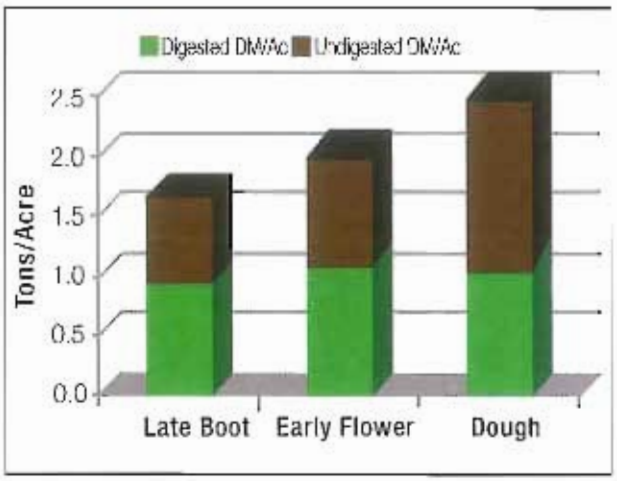

Figure 2. As an illustration of a typical situation, the total yield of tall fescue increases with maturity, but the amount of digestible dry matter (DM)/acre does not generally increase beyond the late boot stage. Because of increasing fiber and lignin concentrations, more undigestible DM is produced and lowers the quality.

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Because of the effects of advancing maturity on quality, it is critical to harvest the crop whenever the forage reaches the recommended stage for harvest. **Table 2** lists the maturity stages that should be targeted for some of the major forage crops. Delaying a harvest beyond the recommended maturity stage will result in forage that is less digestible and much less capable of being consumed at a high rate of intake. Harvesting slightly earlier than the recommended maturity is an option and may be advisable to avoid weather-related risk.

Table 2. Harvest recommendations for some of the major hay crops.

Harvest Recommendations			
Hay Crop	**First Harvest**	**Subsequent Cutting**	**Special Considerations**
Alfalfa*	Late bud stage	Early bloom (usually after every 28-32 days).	In the spring after establishment, allow the first cutting to reach mid bloom.
Annual Ryegrass	Boot stage	When regrowth reaches 10-12 in. (if applicable)	Harvest if forage growth ceases because of hot or dry weather.
Bermudagrass	12 - 16 inches	3.5 - 5 week intervals	If the variety rarely gets taller than 14 - 15 inches, take the first harvest at 12 inches.
Orchardgrass	Boot - early head	4 - 6 week intervals	Harvest if forage growth ceases because of hot or dry weather.
Red or Ladino Clover	Early Bloom	Early Bloom	When grown with a grass, cut at the correct the correct stage for the grass.
Small Grains	Boot-early head	N/A	If the boot-early head stage is missed, take the first harvest at the dough stage
Tall Fescue	Boot-early head	4 - 6 week intervals	Harvest if forage growth ceases because of hot or dry weather.
Winter Annual Legume	Early Bloom	N/A	When grown with a grass, cut at the correct stage for the grass.

* These recommendations aid the longevity of the alfalfa stand in the South and may not be appropriate for other areas in the U.S., especially when extremely high quality is desired.

Management Factors That Affect Mineral Content

Like its impact on protein and digestible energy content, plant maturity is a crucial factor affecting mineral content in forages. Actively growing plant tissue generally has higher concentrations of P, Mg, and K. Mature forage generally has lower Co, Cu, Fe, Mo, and Zn. In contrast, the Ca levels are usually not affected by maturity.

Forage species also vary in mineral content (**Table 3**). Legumes generally have higher concentrations of Ca, Mg, K, Cu, Zn, and Co than grasses, while grasses are generally higher in Mn. However, mineral content in the various forage species may also be substantially affected by the soil in which they are growing. Soil fertility has a major impact on mineral

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Table 3. Observed mineral content in various types of forage grown in Texas (Greene, Personal Communication) relative to the requirement in the diet of selected classes of beef cattle (NASEM, 2016. Nutrient Requirements of Beef Cattle, 8th Revised Ed.).

	Ca	P	Mg	K	S	Cu	Mo	Zn	Se	Mn
	%					ppm				
Forage Type										
Legume	1.43	0.25	0.25	1.47	0.24	12.4	1.85	23.0	0.295	47.6
Warm season grasses	0.41	0.39	0.33	1.71	0.19	6.5	0.68	27.3	0.095	100.1
Cool season perennial	0.38	0.32	0.27	2.25	0.22	5.0	0.99	17.8	0.063	122.0
Cool season annual	0.52	0.26	0.20	3.34	0.18	7.2	1.11	26.0	0.102	91.6
Native grasses	0.48	0.10	0.12	0.91	0.14	5.7	1.50	22.5	0.247	51.6
Cattle requirement										
Growing cattle	0.4-0.8	0.22-0.5	0.10	0.6	0.15	10	n.d.*	30	0.1	20
Cow, gestation	0.16-0.27	0.17-0.22	0.12	0.6	0.15	10	n.d.	30	0.1	40
Cow, early lactation	0.28-0.58	0.22-0.39	0.20	0.7	0.15	10	n.d.	30	0.1	40

* No guidance is available on molybdenum nutrition in the NASEM nutrient requirements.

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nutrition. The status of the soil with regard to the mineral in question would certainly have an impact on the forage's mineral concentration. Soil type and the parent material of the soil can influence the nutrient concentration that is observed. Further, soil pH that is too high or too low can influence mineral content, particularly the micronutrients. Higher pH tends to increase Se and Mo, but may actually reduce Cu, Co, Mn, Fe, and Zn concentrations. Further, fertilization that stimulates plant growth can increase the concentration of the mineral(s) being added, but it may lower other minerals' concentration. Fertilization in excess of the plant's need may result in high or toxic concentrations developing in the forage. Because of the variability induced by different soil fertility and forage management tactics, it is important that the forage mineral content be regularly monitored with a forage test.

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Sodium is one of the most important minerals for animal production. Forages are generally highly variable in Na content, but their concentrations are very low. Consequently, ample supplemental Na, usually in the form of NaCl, should be consistently provided to cattle.