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Energy in Beef Cattle Diets

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Energy Defined

Protein, carbohydrates, and fats provide energy in beef cattle diets. Energy is often referred to as digestible energy, net energy for maintenance (NE_m), net energy for gain (NE_g), net energy for lactation (NE_l), and total digestible nutrients (TDN). On forage and feed quality analysis test results digestible energy in Mississippi beef cattle diets is most commonly expressed as TDN. For practical purposes of ration balancing and determining energy supplementation needs on forage-based diets, TDN is a key value to consider.

When digestible energy becomes limiting in beef cattle diets, intake and animal performance can suffer. Signs of energy deficiency include lowered appetite, weight loss, poor growth, depressed reproductive performance, and reduced milk production. Providing adequate digestible energy in beef cattle diets is important for animal health and productivity as well as ranch profitability.

Carbohydrates are the main source of energy in beef cattle diets. Carbohydrates are either non-structural (readily digested by all livestock) or structural (some are digested through fermentation that occurs in the rumen). Ruminant animals including beef cattle have the unique ability to digest some structural carbohydrates in plant cell walls as a source of energy through microbial activity in the rumen. Structural carbohydrates include cellulose, hemicelluloses, and lignin. Beef cattle can digest cellulose and hemicelluloses through rumen microbial action but cannot digest lignin.

As plants mature, cell walls become more lignified and less digestible. Forage digestibility declines tremendously when forages are allowed to become over mature before cutting or grazing. High ambient temperatures tend to increase plant lignification (production of the indigestible compound lignin), thus lowering digestibility in forages.

It is important to provide cattle with adequate amounts of digestible energy for optimal animal performance. Highly lignified forages are slower to digest than less lignified forages and feeds. Increasing lignin levels in forages consumed by cattle increases time the forage spends in the rumen, decreases dry matter intake, and reduces animal performance. While many factors affect forage digestibility and ultimately TDN, the primary factor that producers can control is forage maturity.

Energy Supplies and Cattle Nutrient Requirements

Beef cattle diets in Mississippi are primarily forage based. Many factors affect digestible energy levels in forage including forage maturity and species. Cool-season grasses such as tall fescue and annual ryegrass are generally more digestible than warm-season grasses such as bermudagrass and dallisgrass. Cool-season annuals (annual ryegrass, wheat, rye) are typically more digestible than cool-season perennials (tall fescue). Legumes like clovers and alfalfa are generally higher in digestibility than grasses. Energy is more likely than protein to be deficient in forage-based beef cattle diets in Mississippi. Recent five-year forage test data from the Mississippi State Chemical Laboratory and the Louisiana State University AgCenter Forage Quality Laboratory support this claim.

Palatability (the acceptableness of a feed or forage to the animal) and intake can become an issue with lower quality forages. Make sure that cattle receiving lower quality forages have acceptable levels of intake. Monitor cow body condition scores, and adjust energy supplementation as appropriate.

Cattle energy requirements vary with stage of production, size of the animal, and expected performance (Figures 1 and 2). Energy as TDN is required for milk production and body maintenance after calving. During lactation, larger cattle typically require more pounds of TDN per day than smaller cattle but as a lesser percentage of their total dry matter intake. Lighter cattle require higher quality feeds and forages at lesser quantities compared with heavier cattle.

Cattle requirements for total digestible nutrients increase with increasing lactation and rate of gain. Although there is often a nutrient deficit after calving of both TDN and crude protein when feeding average quality hay, postpartum cows on forage-based diets are more likely to require longer periods of energy supplementation than protein supplementation.

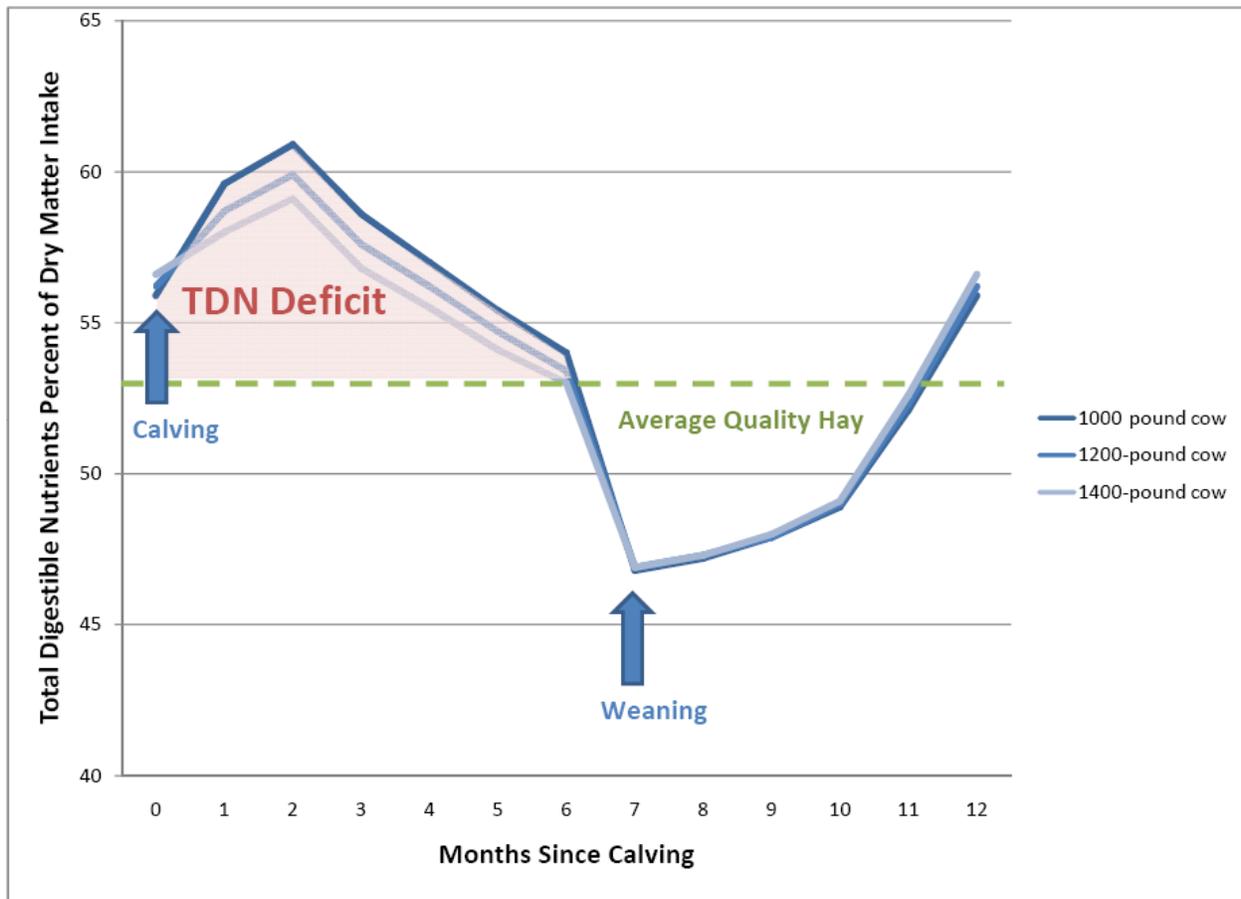


Figure 1. Beef cow total digestible nutrient (TDN) requirements by stage of production¹
¹20-pound expected peak milk production

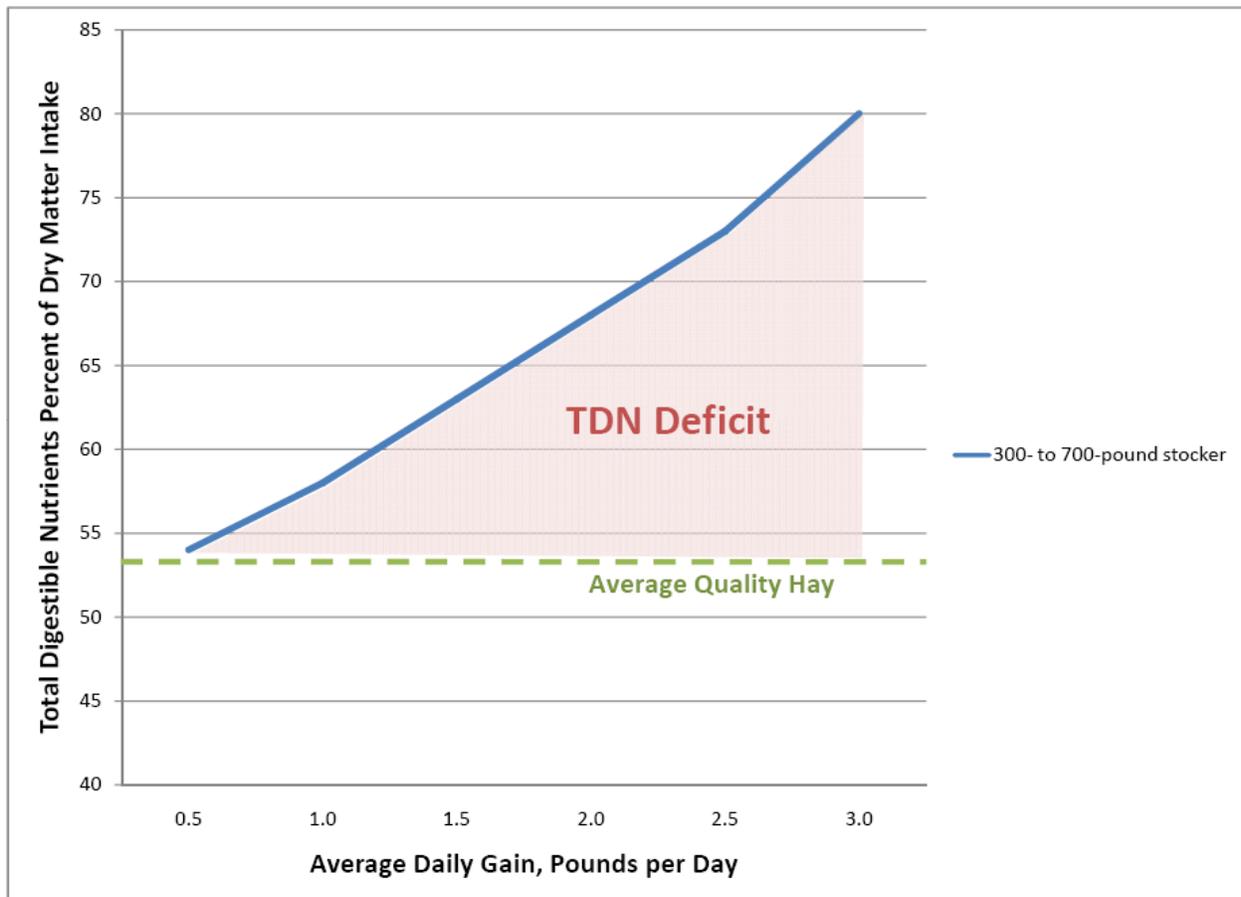


Figure 2. Stocker calf total digestible nutrient (TDN) requirements by rate of gain¹

¹1200-pound expected mature weight

Young, growing cattle, in particular, need relatively high levels of TDN in their diets to support growth. Additional energy and protein are often required to properly balance diets for growing cattle and lactating beef cows on forage-based diets. This is especially true when low quality stored forages are the majority of the diet as is often the case during the winter hay-feeding period after a poor hay production season or with hay produced under low levels of management. Forage quality testing well before feeding is an invaluable tool for determining stored forage TDN concentrations.

Energy Supplements

Energy supplements are available in many forms. High quality forages, commodity co-product feedstuffs, range cubes, protein blocks, and liquid supplements are some examples. Diets containing non-protein nitrogen (urea) must have sufficient carbohydrate levels (energy sources) available in them if the nitrogen in urea is to be effectively utilized. Consider cost per unit of TDN and convenience of various energy supplements. Base purchasing decisions on the cost per pound of TDN rather than the price per pound of supplement.

Feed product labels do not normally report percent TDN or other energy values.

However, producers can still find out TDN estimations for use in nutritional program planning. One option is laboratory nutritional analysis. This service can generally be performed for a nominal fee. Submit forage and feed samples to laboratories such as the Mississippi State Chemical Laboratory or the Louisiana State University AgCenter Forage Quality Laboratory. Another option is to use “book values” from feed composition tables for similar feed ingredients. The Mississippi State University Extension Service can assist producers in obtaining and using this information.

Consider using high-quality forages such as vegetative legumes and cool-season forages to supply TDN in beef cattle diets when possible. If the operation has facilities to store and handle bulk feed ingredients, use commodity-based co-product feedstuffs will usually be the best value for supplementing forage-based diets for stocker calves and lactating cows. Examples of feedstuffs (and their typical TDN concentrations on a dry matter basis) that can serve as effective energy supplements include corn (90%), soybean hull pellets (80%), whole cottonseed (90%), hominy feed (91%), corn gluten feed (83%), dried distillers grains (86%), wheat midds (77%), rice bran (70%), cane molasses (80%), and citrus pulp (80%).

Fats are another source of energy in beef cattle diets. When cattle consume too much fat, feed intake may fluctuate and scouring (diarrhea) may occur. Conservative estimates of maximum recommended fat levels in beef cattle diets are six percent for mature cattle and four percent for young, growing cattle. Examples of feedstuffs (and their typical fat percentages on a dry matter basis) containing relatively high fat percentages include whole cottonseed (18%), rice bran (15%), brewers grains (11%), dried distillers grains (10%), and hominy feed (8%). Feedstuffs high in fat content can be offered in combination with feedstuffs lower in fat content to reduce the overall fat percentage in the diet.

For more information energy in beef cattle diets, contact an office of the Mississippi State University Extension Service.