

Beef Cow Nutrient Requirements — Keys for Successful Feeding

A properly designed beef cow nutrition plan cost-effectively meets the herd's needs throughout the year. Feed represents most of the total cost of maintaining a beef cow. It is one of the few expense items that can be changed relatively quickly.

Feed is not only a major cost item, but the relationship between feed and nutrition also significantly influences reproduction, a critical factor in enterprise profitability. This relationship confirms that the main goal of a cow nutrition program is to maintain an optimal reproductive rate at a profitable cost. This publication discusses the primary factors influencing the nutrient requirements of beef cows.

What are the Biological and Environmental Drivers of Nutrient Demand?

Beef cow maintenance and production depend heavily on meeting specific nutrient requirements. If diets fall short — particularly in energy or protein — cows experience weight loss, reproductive failure, and/or reduced milk production. Several key factors influence a cow's nutritional needs throughout the year. Recognizing these factors allows for more effective decision-making.

The four main biological priorities in cow nutrition are presented below in order of importance. These priorities should be understood and considered when developing a cowherd nutrition program.

1. Maintenance
2. Growth
3. Milk Production
4. Reproduction

The first main priority is maintenance. Maintenance supports the cow's basic body functions, and nutrients consumed are used to meet maintenance needs first.

Growth is the second priority. Beef cows will continue to grow until approximately 4 years of age. Nutrients not used for maintenance will be used to meet growth demands in cows through 4 years of age.

The third biological priority is milk production. Once maintenance and growth needs are met, nutrients are used to support calf growth through milk production. Milk production can have a large influence on a cow's total nutrient requirements; milk production is greatest approximately 55 to 65 days after calving and represents the time when total nutrient requirements are also highest. However, nonlactating cows with genetic potential for higher milk production also have increased energy requirements mainly due to having larger organs. Undersupplying nutrients, primarily energy, can lower milk production and ultimately inhibit calf growth.

Reproduction is the last biological priority of nutrient use in the cow. Nutrient requirements for maintenance, growth, and milk production must be met first before nutrients are used for reproductive functions. However, because of the influence of reproduction on the profitability of the



Photo 1. It is important to manage young and older cows separately from mature cows so strategic supplementation can be targeted by age group.

cowherd, understanding how requirements change across reproductive stages is important.

Stage of Reproduction

The cow's yearly production cycle is divided into four distinct periods or stages (Table 1). Understanding which period of the production cycle a cow is in is necessary for properly building nutrition programs.

Period 1 is critical to beef cow performance, occurring during early lactation when nutrient demands peak. The cow must nurse her calf and rebreed within 80 to 85 days to maintain a 365-day calving interval. Peak lactation, around 55 to 65 days post-calving, drives the highest protein and energy needs to support milk production. Inadequate nutrition during this period can lead to weight loss, deterioration in body condition, reduced milk yield, decreased calf weaning weight, and delay in return to estrus following calving.

Period 2 corresponds to early gestation and mid- to late-lactation. Although the cow is pregnant, the fetus's nutrient needs are still relatively low, and milk production is slowly declining. During this time, spring-calving herds usually have access to actively growing, moderate- to high-quality forage to meet needs, while fall-calving herds may face nutrient challenges requiring supplementation due to diminishing forage quality in native range pastures and increased weather stress.

Period 3 marks mid-gestation and often coincides with calf weaning. Nutrient demands are at their lowest point in the production cycle, especially if the cow is no longer nursing a calf. Even if cows are lactating during this period, milk production is low and decreasing. This phase represents a time for easier and more economical body condition gain before the next calving season, if necessary.

Period 4 is the last 90 days before calving, a critical window of time for both newborn calf health and subsequent cow reproduction. Nutrient needs rise as the unborn calf and placental tissue grow as calving approaches. During this time, the cow builds antibodies that are passed to the calf through colostrum. Poor nutrition in late gestation can lead to lighter birth weights, increased calf mortality, reduced colostrum and milk production, delayed return to estrus, and reduced conception rates.

Age and Growth Stage

Cows continue growing until approximately 4 years of age. Younger cows (particularly 2- and 3-year-olds) require additional nutrients to support growth in addition to those required for maintenance and lactation. Due to additional growth requirements, cows through 4 years of age typically have a longer anestrus period post-calving. Manage young and/or older cows separately from middle-aged (4 to 8 years of age) mature cows so strategic supplementation can be targeted by age group.

Cow Weight

Just as age affects nutritional needs, a cow's weight also influences how much energy and protein is required. At a constant level of milk production, heavier cows require more energy and protein to meet maintenance needs (Table 2). In general, feed intake increases with body weight.

Body Condition Score

The cow body condition score (BCS) system is a practical tool for monitoring nutrition status and making informed herd management decisions. Body condition score affects the energy requirements of cows. Energy requirements are higher for cows with increased BCS over thinner cows because of the demand to maintain fat tissue storage.

Cows in poor condition at calving often experience delayed return to estrus and reduced conception rates. Ideally, mature cows should calve in a BCS \geq 5.0, and young cows (2- and 3-year-olds) should calve in a BCS \geq 6.0.

Excessive BCS (\geq 7.0) at calving increases the risk of calving difficulty and increases feed costs. Likewise, it is recommended to avoid major losses in BCS before either calving or breeding. Separating and feeding cows by BCS helps minimize over- or under-supplementation.

Additional resources on the BCS system include: *Nutritional Management of Cows by Body Condition (MF3275)* (<https://bookstore.ksre.ksu.edu/item/MF3275>), *Beef Cow Body Condition Scoring (MF3677)* (<https://bookstore.ksre.ksu.edu/item/MF3677>), and *Body Condition Scorecard for Cattle (MF3230)* (<https://bookstore.ksre.ksu.edu/item/MF3230>).

Table 1. The annual production cycle of the beef cow by period.

Period	1	2	3	4
Approx. Length (Days)	82	123	70	90
Biological Activity	Post-calving, but before breeding	Early gestation and mid- to late-lactation	Mid-gestation	Late-gestation

Environmental Conditions

Energy requirements increase with physical activity, especially when cows graze in rough terrain or must walk long distances to water. Estimates suggest energy needs due to physical activity can rise by 10% to 50%, though adjustments to feeding programs should be made cautiously. In confinement or semi-confinement systems, additional energy demands due to activity are minimal.

When cattle are exposed to temperatures below their estimated lower critical temperature, energy needs increase to maintain body temperature. For each degree Fahrenheit (°F) below that point, dietary energy should be increased by 1% to 2%, depending on hair coat condition.

Additional information on the effect of cold stress on cow nutrient requirements may be found in *Managing Beef Cows During Cold Stress (MF3684)* (<https://bookstore.ksre.ksu.edu/item/MF3684>).

Main Points to Remember About Cow Nutrient Requirements

- Maintenance, growth, milk production, and reproduction are the four main priorities of cow nutrient use — in that order.
- Nutrient requirements change throughout the year, depending on the reproductive stage.
- Cows through 4 years of age have additional nutrient demands to support growth.
- Maintenance needs for protein and energy increase as body weight and lactation potential increase.
- Cows with different body condition scores (BCS) have different energy needs, and the BCS system should be used as a tool to guide feeding programs.
- Environmental stress, particularly cold stress, raises maintenance energy needs.
- The periods most critical for cow reproduction are late-gestation and early-lactation.
- Mid-gestation is the time when body weight and BCS can be increased most easily and cost-effectively.
- Energy and/or protein deficiencies, particularly around the time of calving, are the most common causes of weight and BCS loss going into the breeding season, contributing to reproductive failure.
- Strategic timing of calving to match the period of highest nutrient requirements (post-calving and before breeding) with the highest forage quality can reduce the need for additional protein and energy supplementation.

Table 2. Relationship between cow milk production level and body weight on nutrient requirements.¹

Cow Body Weight (lb) ²	Milk Production (lb/day) ³	Requirement		
		TDN (lb/day)	NE _m (Mcal/day)	Crude Protein (lb/day)
1,000	10	12.5	12.4	2.0
	20	15.2	15.5	2.8
	30	17.9	18.9	3.6
1,200	10	13.9	13.7	2.2
	20	16.7	16.9	2.9
	30	19.3	20.2	3.7
1,400	10	15.3	14.9	2.4
	20	18.0	18.3	3.1
	30	20.7	21.3	3.9

¹Data from Nutrient Requirements of Beef Cattle, 7th Revised Edition.

²Weight as a mature cow.

³Peak lactation at 2 months post-calving.

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