

Nutrient Requirements of Beef Cattle

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Department of Animal Science • Oklahoma Cooperative Extension Service
• Division of Agricultural Sciences and Natural Resources • Oklahoma State University

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Beef Cattle





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Objectives

- Discuss the nutrient requirements of beef cattle
- Provide tables that list the nutrient requirements of beef cattle

A balanced and cost effective nutrition program is essential to the success of any beef cattle operation. Expensive grasslands demand efficient utilization of forages. Supplemental feeding and complete feeding programs must be designed to meet the nutrient needs of beef cattle and, at the same time, make the most of the available feed resources. Nutrient requirements of cattle change with age, stage of production, sex, breed, environmental conditions, and basal diet quality and amount. Therefore, gaining knowledge of nutrient requirements and the factors influencing these requirements is a necessary first step to designing a nutrition program that is both efficient and cost effective. This section will discuss the protein, energy, mineral, and vitamin requirements of beef cattle. In addition, tables of nutrient requirements are provided.

Dry Matter Intake

There really is no requirement for feed intake, although an estimate of how much forage and feed that an animal will consume is essential when evaluating rations, supplements, or predicting animal performance. Dry matter (DM) intake is influenced by a number of different factors. A few of the more important variables include animal weight, condition, stage of production, level of milk production, forage quality, amount and type of supplement or feed provided, as well as environmental conditions.

Cattle have a daily requirement for a certain quantity of specific nutrients such as protein, calcium, and vitamin A. The necessary concentration of these nutrients in the diet (to meet the animal's requirement) is then determined by the amount of feed consumed. For example, steer calves gaining 2 lbs per day may require 1.6 lbs of protein per day. If they consume 15 lbs of DM daily, the protein requirement could be expressed as 10.7% of DM intake. On the other hand, if they are limit fed to consume only 10 lbs of DM daily, the protein requirement for 2 lbs of gain could be expressed as 16% of DM intake.

Intake in forage-fed cattle is generally limited by the forage capacity of the digestive tract. Values presented in Table 11.1 provide rule-of-thumb guidelines for variation in DM intake based on differences in forage quality and stage of production for beef cows. Forage digestibility values rarely exceed 70% to 74% of DM. Calves and yearlings are frequently fed higher quantities of concentrate feeds to improve weight gain and feed conversion above what can be achieved with forage alone. When diet digestibility approaches around 70%, feed intake is no longer regulated or limited by the capacity of the digestive tract. Rather, with diets high in digestible energy, physiological mechanisms are turned on to limit intake (Figure 11.1). This response can be thought of as a built in safety mechanism so that cattle are less likely to consume too much of a highly digestible diet, causing digestive upset, bloat, and founder.

Forage intake is highly correlated with forage quality as shown in Figure 11.2 and in Table 11.1. The more rapid rate of digestion and passage of higher quality forage results in considerably higher dry matter intake compared to forage that is lower in digestibility. Cattle with greater mature body weight and frame size consume more forage compared to smaller frame cattle and lactating cows consume considerably more of the same quality forage compared to gestating cows (Figure 11.3). Additionally, cattle that are fleshy

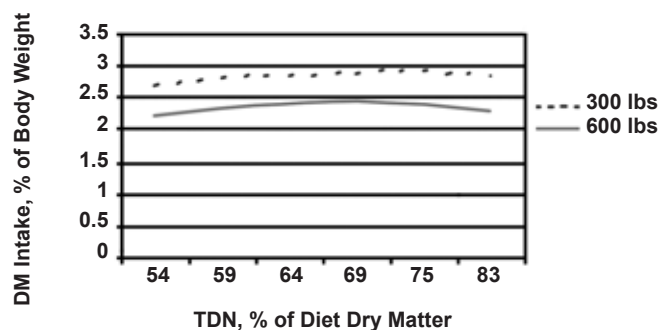


Figure 1. The relationship of diet digestibility to dry matter intake in growing calves. Source: NRC.

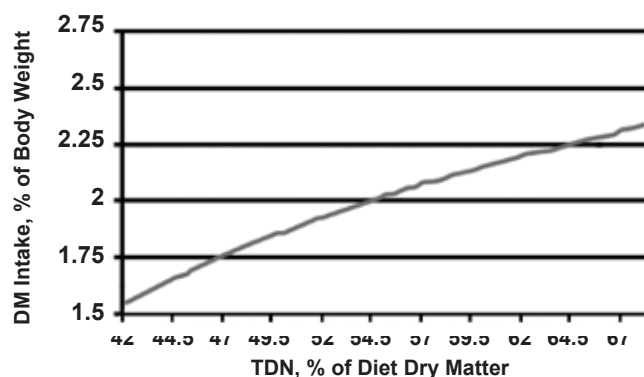


Figure 2. The relationship of forage digestibility to dry matter intake in beef cows. Source: NRC.

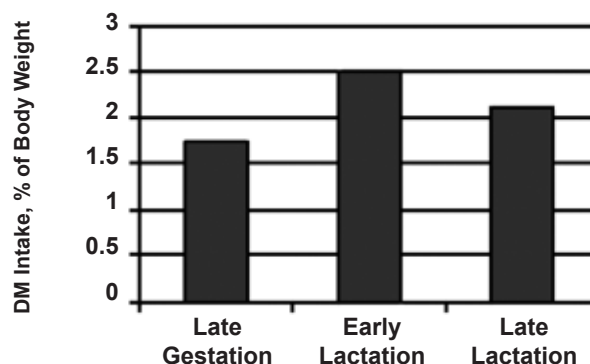


Figure 3. Dry matter intake, expressed as percent of body weight, of beef cows consuming low quality forage during three different stages of production. Source: Johnson et al.

consume 3 to 10% less feed or forage compared to cattle that are in average to thin condition. Cold stress increases dry matter intake, while heat stress reduces dry matter intake. With this many factors influencing this trait, it is obvious that dry matter intake is very difficult to accurately predict.

Estimates of dry matter intake presented in the nutrient requirement tables are determined using published prediction equations. These equations take into account the effects of the

Table 1. Forage capacity of beef cows^a.

Forage Type and Maturity	Stage of Production	Forage Dry Matter Intake Capacity, % of Body Weight
Low quality forage (< 52% total digestible nutrients) Dry winter forage, mature legume and grass hay, straw	Dry	1.8
	Lactating	2.2
Average quality forage (52% to 59% total digestible nutrients) Dry summer pasture, dry pasture during fall, late-bloom legume hay, boot stage and early-bloom grass hay	Dry	2.2
	Lactating	2.5
High quality forage (> 59% total digestible nutrients) Mid-bloom, early-bloom, and prebloom legume hay, preboot stage grass hay	Dry	2.5
	Lactating	2.7
Lush, growing pasture	Dry	2.5
	Lactating	2.7
Silages	Dry	2.5
	Lactating	2.7

^a Intake estimates assume that protein requirements are met by the forage or through supplementation when forage protein is not adequate. When protein requirements are not met, forage intake will be lower than the values shown in the table.

Source: Hibbard and Thrift.

animal's weight, level of milk production for lactating cows, energy content of the diet, stage of production, and body condition in the case of the pregnant replacement heifers. It is important to note that all of these equations assume that adequate protein is supplied in the diet to maximize ruminal fermentation. In other words, if the diet is deficient in protein, these dry matter intake values will overestimate the amount that the cattle will actually consume.

Protein

Proteins are large chemical units made up of hundreds of amino acids. Amino acids, in turn, are organic or carbon containing compounds that also contain nitrogen, oxygen, and sometimes sulfur. Animals consume proteins in their diets and then utilize the amino acids for synthesis of muscles, blood proteins, and other body components. In swine, poultry, and other nonruminants, the amino acids must be supplied in definite proportions in the diet. However, in ruminants, microorganisms (bacteria and protozoa) breakdown most dietary proteins and incorporate the nitrogen and amino acids into their own body tissue. The microorganisms are digested in the small intestine of the ruminant animal. The bacteria themselves have a protein requirement and must have adequate protein to do their job of digesting roughages to end products that can be utilized by the cow.

Because of the ruminal breakdown of dietary proteins and because the amino acid make-up of microorganisms is adequate for most classes of beef cattle, feed and forage amino acid composition is generally not critical compared to nonruminant diets. On the other hand, a high priority should be placed on providing adequate ruminally available protein in order to allow the bacteria to grow and digest roughages. Chemical crude protein concentration is determined by multiplying the feed nitrogen concentration by 6.25 because protein molecules contain an average of 16% nitrogen ($1/16 = 6.25$). The crude protein system has been the standard for evaluating beef cattle protein requirements and dietary supply for a long time.

More recently, the metabolizable protein system has been used to better characterize protein degradability as well as its site and extent of digestion. In order to effectively use this new system, the user must become familiar with several new terms. These include degradable intake protein (DIP), undegradable

intake protein (UIP), and metabolizable protein (MP). Degradable intake protein is the feed protein fraction that is degraded in the rumen. Nitrogen from DIP is either used for microorganism protein synthesis or passes through the rumen wall into the blood stream and is carried to the liver as ammonia. In the liver this nitrogen can be converted to urea after which it is recycled to the rumen through saliva or filtered out of the blood stream in the kidney to be excreted in the urine. Undegradable intake protein is the feed protein fraction that bypasses fermentation in the rumen to be degraded and absorbed in the small intestine. Metabolizable protein is the sum of protein derived from microorganism origin plus UIP (Figure 4).

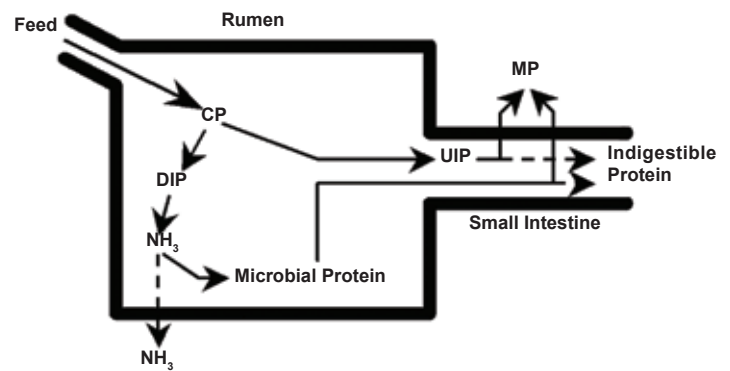


Figure 4. Illustration of protein digestion and absorption in the ruminant. Source: Lalman.

Perhaps one of the most practical applications of the MP system is the calculation of the animal's DIP requirement to ensure optimal rumen function. For this reason, feed DIP values are included in Table 12.1, page 115. The requirement for DIP is thought to be closely associated with the amount of fermentable energy in the diet. Specifically, the DIP requirement can be calculated as 10% to 13% of daily total digestible nutrients (TDN) intake. Lower values in this range are used when the cattle are receiving a low quality diet, such as dry winter range forage or low quality hay, whereas higher values in the range are used when the cattle are receiving high quality forage or a ration including at least 50% concentrate. The UIP value of the feed can also be calculated by subtracting the DIP value from one.

Example of DIP requirement and supply: Assume a cow is consuming 25 lbs of hay dry matter that contains 50% TDN. The cow therefore consumes a total of 12.5 lbs of TDN per day. Therefore, the DIP requirement is 12.5 lbs x 10%, or 1.25 lbs of DIP per day. If the hay contains 6% CP (dry matter basis), of which 65% is DIP, this cow would consume 0.98 lb of DIP each day (6% x 65% x 25 lbs). The requirement for supplemental DIP would be 0.27 lb (1.25 lbs – 0.98 lb).

Nutrient requirements, including protein requirements, for beef cows and replacement heifers are shown in Tables 11.2 and 11.3. Requirements for growing calves and yearlings are shown in Tables 11.4 and 11.5. Requirements for growing and mature bulls are shown in Table 11.6. These values were adapted from the National Research Council's Nutrient Requirements of Beef Cattle publication. One exception is that the NRC calculates the crude protein requirement for some classes of cattle to be less than 7%. Research demonstrates that ruminal fermentation may be compromised with low protein diets. Therefore, 7% dietary crude protein was the minimum value used in the nutrient requirement tables in this publication.

The requirements are expressed in both pounds per day of crude protein and in terms of the percentage required in the diet dry matter. These tables illustrate the influence of age, weight, desired rate of weight gain, stage of production, and genetic milking ability on nutrient requirements.

Replacement heifers need to gain about 1 to 1.5 lbs/day in order to reach 60% to 65% of their expected mature weight and puberty by 15 months of age. They also need to gain around 1 lb/day from the time they are bred until they calve in order to reach approximately 80% of their mature weight when they calve for the first time. The requirement of protein for muscle and organ growth is reflected in the large daily requirement for protein. Growing heifers require a high concentration of protein in the diet because of their low dry matter intake. They must have access to good quality forage or be fed supplemental protein to achieve adequate growth prior to their first breeding season.

Gestation has little effect on the cow's protein requirement until about the seventh month of pregnancy. About 2/3 of the fetal growth occurs during the last 1/3 of pregnancy and the protein intake of the cow should be increased during the last 1/3 of pregnancy to ensure that the cow will be in good condition at the time of calving. The cow is programmed to take care of the fetus at the expense of her own body, and losses of body condition frequently occur in late pregnancy when daily protein or energy are not increased to match the needs of the pregnant cow. Adequate dietary protein during this period is also essential for the cow to produce abundant, high quality colostrum or first milk, which will influence the newborn's immune system for the remainder of its life.

Lactation is the most nutritionally stressful activity for the cow. The modern commercial beef cow produces around 20 lbs of milk each day during peak lactation. Milk contains a high concentration of protein. Therefore, lactating cows, particularly during early lactation, require nearly twice the daily protein of dry cows. Research shows that cows in moderate condition at calving should at least maintain body weight from calving to rebreeding for good conception rates. Failure to take into account the increased protein demand brought on by lactation may result in long intervals before rebreeding. Beef breeds with superior milking ability (25 to 30 lbs/day), and selection for high milk production within a breed have an even higher protein requirement.

Increasing cow size adds to the daily protein requirement but not nearly to the extent that lactation does. As mature size increases,

more protein is required to maintain the heavier muscle mass and to permit faster gains that must be made by young females of larger breeds.

Energy

The cow requires energy for grazing, traveling, fetal development, milk production, temperature maintenance, reproduction, digestion, and voiding of body wastes. In addition, first- and second-calf heifers require additional energy for growth until they mature at about 4 years of age. If cows are thin, additional energy will be required to restore their body condition to a moderate level. The bulk of energy for grazing cattle comes from rumen digestion of forages and roughage products. With proper amounts of protein and minerals, the rumen is capable of getting energy from a wide range of feeds that are useless to nonruminants.

Because the rumen bacteria themselves require protein, just as the animal's body does, it is impossible to discuss ruminant energy requirements separately from ruminant protein requirements. With too little protein in the diet, the bacteria will not efficiently digest roughages; with too much protein in the diet, the protein will be deaminated. Deamination is the process of removing the nitrogen from the protein molecule. When this occurs, protein is used as a very expensive energy source.

Energy requirements are expressed in the table in terms of TDN and net energy for maintenance (NEM) and/or net energy for gain (NEg). TDN is the sum of the digestible starch, fiber, protein, and fat in a feed with a correction factor for the high energy content of fat and the amount of ash or mineral content. TDN requirements are expressed as a percent of the diet dry matter as well as in pounds per day required. Net energy requirements are expressed in terms of mega calories per pound of feed and mega calories required per day.

A close look at the nutrient requirement tables shows that the same factors that influence protein requirements also influence energy requirements: animal weight, rate of gain, lactation, and fetal development. Lactation represents the greatest need for additional energy beyond that needed for maintenance. An average milking beef cow requires nearly 50% more TDN or net energy than she does when dry. It should be noted that lactating cows consume more forage compared to gestating cows due to the increased energy demand.

Energy requirements for first-calf heifers are higher than for mature cows because energy is needed for growth, in addition to body maintenance and lactation. Inadequate energy during the last third of gestation and during the critical time from calving to rebreeding can lead to poor rebreeding.

Large cows will require more energy than will small cows. For example, a 1,300-lb dry pregnant cow in the middle third of pregnancy requires 32% more TDN per day than a 900-lb cow at the same stage of production. Producers who are increasing the mature size of their cows should recognize the greater energy requirements of the larger cows and reduce their stocking rates to compensate.

Vitamins and Minerals

The National Research Council publishes equations to determine calcium and phosphorus requirements and these estimated requirements are shown in Tables 11.2 through 11.6. Less is known about specific dietary requirements for the other important macro and micro minerals. Therefore, the National Research Council provides general dietary guidelines and maximum tolerable levels for each of these minerals (Table 11.7). Specific functions and

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sources of vitamins and minerals are discussed in greater detail in Chapter 14.

Water

Do not forget that water is a common but an entirely essential nutrient. Water intake increases dramatically with increased age, weight, and temperature (Table 11.8). Clean water is most important for young growing calves, but dirty water can retard performance and be a breeding ground for disease in cattle of all ages.

Other Considerations

The requirements shown in the tables are designed for healthy unstressed cattle in good condition. Thin heifers or cows should be fed additional energy and protein to achieve good body condition. Some additional energy should be allowed for cows having to travel over large areas for feed or water. Cows subjected to extremely cold temperatures, especially if combined with rain or snow, need extra energy for maintenance. The protein requirement is not increased during cold stress, however. Kansas State University research, for example, shows that a 1,200-lb cow subjected to 20°F in a 14 mph wind requires about 28% more energy than at 32°F with no wind.

Conclusion

Nutrient requirements include those for protein, energy, vitamins, minerals, and water. Nutrient requirements vary dramatically among animals and are influenced by age, weight, stage of production, rate of growth, environmental conditions, breed, gender, and other factors. Tabular data provided in this chapter should assist beef producers in determining specific nutrient requirements for their cattle.

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Table 2. Nutrient requirements of beef cows.

Gestating cow, middle 1/3 of pregnancy														
Weight (lbs)	Expected Calf Birthweight (lbs)	DM Intake (lbs/day)	% of BW	Diet Nutrient Density					Daily Nutrients per Animal					
				TDN (%DM)	NEm (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NEm (Mcal)	CP (lbs)	Ca (lb)	P (lb)	
900	63	17	1.9	50	0.44	7.1	0.17	0.14	8.3	7.3	1.2	0.028	0.023	
1000	69	18	1.8	50	0.44	7.1	0.17	0.14	9.0	7.9	1.3	0.031	0.025	
1100	75	19	1.8	50	0.44	7.1	0.17	0.14	9.7	8.5	1.4	0.034	0.028	
1200	80	21	1.7	50	0.44	7.1	0.18	0.15	10.3	9.1	1.5	0.037	0.030	
1300	86	22	1.7	50	0.44	7.1	0.18	0.15	11.0	9.7	1.6	0.040	0.033	
1400	91	23	1.7	50	0.44	7.1	0.19	0.15	11.6	10.2	1.6	0.043	0.035	
1500	96	25	1.6	50	0.44	7.1	0.19	0.15	12.2	10.8	1.7	0.046	0.038	
Gestating cow, last 1/3 of pregnancy														
900	63	19	2.1	54	0.50	7.9	0.25	0.16	10.3	9.6	1.5	0.047	0.030	
1000	69	21	2.1	54	0.50	7.9	0.25	0.16	11.2	10.4	1.6	0.052	0.034	
1100	75	22	2.0	54	0.50	7.9	0.25	0.16	12.1	11.2	1.8	0.057	0.037	
1200	80	24	2.0	54	0.50	7.9	0.26	0.17	12.9	12.0	1.9	0.061	0.040	
1300	86	25	2.0	54	0.50	7.9	0.26	0.17	13.7	12.8	2.0	0.066	0.043	
1400	91	27	1.9	54	0.50	7.9	0.26	0.17	14.5	13.5	2.1	0.071	0.046	
1500	96	28	1.9	54	0.50	7.9	0.27	0.17	15.3	14.2	2.2	0.075	0.049	
Lactating cow, first 90 days after calving														
Weight (lbs)	Peak Milk lbs/day	Milk (kgs)	DM Intake (lbs/day)	% of BW	Diet Nutrient Density					Daily Nutrients per Animal				
					TDN (%DM)	NEm (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NEm (Mcal)	CP (lbs)	Ca (lb)	P (lb)
900	10	4.5	22	2.5	56	0.53	8.7	0.24	0.17	12.4	11.7	1.9	0.052	0.037
	15	6.8	24	2.7	57	0.55	9.6	0.27	0.18	13.7	13.3	2.3	0.065	0.044
	20	9.1	26	2.9	59	0.58	10.4	0.30	0.20	15.3	14.9	2.7	0.077	0.051
1000	10	4.5	24	2.4	55	0.52	8.5	0.23	0.17	13.0	12.3	2.0	0.055	0.039
	15	6.8	26	2.6	57	0.55	9.4	0.27	0.18	14.5	14.0	2.4	0.068	0.047
	20	9.1	27	2.7	59	0.57	10.2	0.29	0.20	16.0	15.6	2.8	0.080	0.054
1100	15	6.8	27	2.5	57	0.54	9.2	0.26	0.18	15.3	14.6	2.5	0.071	0.049
	20	9.1	29	2.6	58	0.56	10.0	0.29	0.19	16.8	16.3	2.9	0.083	0.056
	25	11.4	31	2.8	59	0.58	10.6	0.31	0.21	18.2	17.9	3.3	0.095	0.064
1200	15	6.8	29	2.4	57	0.54	9.0	0.26	0.18	16.1	15.3	2.6	0.074	0.051
	20	9.1	30	2.5	58	0.56	9.8	0.28	0.19	17.6	16.9	3.0	0.086	0.059
	25	11.4	32	2.7	59	0.58	10.5	0.31	0.21	19.0	18.6	3.4	0.098	0.066
1300	15	6.8	30	2.3	56	0.53	8.9	0.26	0.18	16.8	16.0	2.7	0.077	0.054
	20	9.1	32	2.4	57	0.55	9.6	0.28	0.19	18.1	17.6	3.1	0.089	0.061
	25	11.4	34	2.6	59	0.57	10.3	0.30	0.20	19.7	19.2	3.4	0.102	0.069
1400	20	9.1	33	2.4	57	0.55	9.5	0.28	0.19	18.9	18.2	3.1	0.092	0.064
	25	11.4	35	2.5	59	0.57	10.1	0.30	0.20	20.5	19.8	3.5	0.105	0.071
	30	13.6	37	2.6	59	0.58	10.6	0.32	0.21	21.8	21.5	3.9	0.117	0.078
1500	20	9.1	35	2.3	57	0.55	9.3	0.28	0.19	19.7	18.8	3.2	0.095	0.066
	25	11.4	37	2.4	58	0.56	9.9	0.30	0.20	21.2	20.5	3.6	0.108	0.073
	30	13.6	38	2.6	59	0.58	10.5	0.31	0.21	22.6	22.1	4.0	0.120	0.081

Table 3. Nutrient requirements of pregnant replacement heifers.
Pregnant yearling replacement heifer, middle 1/3 of pregnancy

Current Weight (lb)	Current BCS ^a (1-9)	ADG ^b (lb)	DM Intake		Diet Nutrient Density					Daily Nutrients per Animal				
			(lb/day)	% of BW	TDN (%DM)	NE _m (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lb)	NE _m (Mcal)	CP (lb)	Ca (lb)	P (lb)
1000 lb Mature Weight @ BCS=5														
600	5	1.0	13	2.2	54	0.49	9.1	0.42	0.17	7.2	6.6	1.2	0.057	0.023
		1.5	14	2.3	56	0.53	10.2	0.48	0.20	7.8	7.4	1.4	0.066	0.028
		2.0	15	2.4	59	0.58	11.4	0.53	0.23	8.5	8.4	1.6	0.077	0.033
700	6	1.0	15	2.2	54	0.50	8.5	0.38	0.16	8.2	7.6	1.3	0.058	0.025
		1.5	16	2.3	57	0.55	9.5	0.43	0.19	9.0	8.7	1.5	0.068	0.030
		2.0	17	2.4	60	0.59	10.4	0.47	0.21	9.9	9.8	1.7	0.078	0.034
800	7	1.0	16	2.0	56	0.53	8.4	0.37	0.16	9.2	8.7	1.4	0.060	0.027
		1.5	17	2.1	59	0.58	9.1	0.41	0.18	10.1	9.9	1.6	0.069	0.031
		2.0	18	2.2	62	0.62	9.8	0.44	0.20	11.0	11.0	1.7	0.077	0.035
1200 lb Mature Weight @ BCS=5														
750	5	1.0	16	2.1	53	0.48	8.7	0.40	0.17	8.3	7.6	1.4	0.062	0.026
		1.5	16	2.2	55	0.52	9.8	0.45	0.19	9.0	8.5	1.6	0.073	0.032
		2.0	17	2.3	58	0.56	10.7	0.49	0.22	9.8	9.5	1.8	0.083	0.037
850	6	1.0	17	2.0	54	0.49	8.2	0.37	0.16	9.3	8.6	1.4	0.064	0.028
		1.5	18	2.1	56	0.53	9.1	0.41	0.18	10.2	9.6	1.6	0.074	0.033
		2.0	19	2.2	59	0.57	9.9	0.45	0.20	11.0	10.8	1.9	0.084	0.038
950	7	1.0	19	1.9	56	0.52	8.2	0.36	0.16	10.3	9.7	1.5	0.067	0.030
		1.5	19	2.0	58	0.56	8.9	0.39	0.18	11.1	10.8	1.7	0.075	0.035
		2.0	20	2.1	61	0.60	9.4	0.42	0.19	12.0	11.9	1.9	0.083	0.038
1400 lb Mature Weight @ BCS=5														
900	5	1.0	18	2.0	53	0.48	8.5	0.38	0.17	9.4	8.5	1.5	0.068	0.030
		1.5	18	2.0	55	0.51	9.3	0.42	0.19	10.0	9.4	1.7	0.078	0.035
		2.0	19	2.1	57	0.55	10.1	0.46	0.21	10.9	10.5	1.9	0.088	0.040
1000	6	1.0	20	1.9	53	0.49	8.0	0.36	0.16	10.3	9.4	1.6	0.069	0.032
		1.5	20	2.0	56	0.52	8.9	0.40	0.18	11.2	10.6	1.8	0.080	0.037
		2.0	21	2.1	58	0.56	9.5	0.43	0.20	12.1	11.7	2.0	0.089	0.041
1100	7	1.0	21	1.9	55	0.52	8.0	0.35	0.17	11.3	10.6	1.6	0.072	0.034
		1.5	21	1.9	58	0.55	8.7	0.39	0.18	12.2	11.8	1.9	0.082	0.039
		2.0	22	2.0	60	0.59	9.3	0.41	0.20	13.2	13.0	2.0	0.091	0.043

^a Body Condition Score

^b Average Daily Gain

Table 3. Nutrient requirements of pregnant replacement heifers.

Pregnant yearling replacement heifer, middle 1/3 of pregnancy														
Current Weight (lbs)	Current BCS ^a (1-9)	ADG ^b (lbs)	DM Intake (lbs/day)	% of BW	Diet Nutrient Density					Daily Nutrients per Animal				
					TDN (%DM)	NE _m (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NE _m (Mcal)	CP (lbs)	Ca (lb)	P (lb)
1000-lb Mature Weight @ BCS=5														
600	5	1.0	13	2.2	54	0.49	9.1	0.42	0.17	7.2	6.6	1.2	0.057	0.023
		1.5	14	2.3	56	0.53	10.2	0.48	0.20	7.8	7.4	1.4	0.066	0.028
		2.0	15	2.4	59	0.58	11.4	0.53	0.23	8.5	8.4	1.6	0.077	0.033
700	6	1.0	15	2.2	54	0.50	8.5	0.38	0.16	8.2	7.6	1.3	0.058	0.025
		1.5	16	2.3	57	0.55	9.5	0.43	0.19	9.0	8.7	1.5	0.068	0.030
		2.0	17	2.4	60	0.59	10.4	0.47	0.21	9.9	9.8	1.7	0.078	0.034
800	7	1.0	16	2.0	56	0.53	8.4	0.37	0.16	9.2	8.7	1.4	0.060	0.027
		1.5	17	2.1	59	0.58	9.1	0.41	0.18	10.1	9.9	1.6	0.069	0.031
		2.0	18	2.2	62	0.62	9.8	0.44	0.20	11.0	11.0	1.7	0.077	0.035
1200-lb Mature Weight @ BCS=5														
750	5	1.0	16	2.1	53	0.48	8.7	0.40	0.17	8.3	7.6	1.4	0.062	0.026
		1.5	16	2.2	55	0.52	9.8	0.45	0.19	9.0	8.5	1.6	0.073	0.032
		2.0	17	2.3	58	0.56	10.7	0.49	0.22	9.8	9.5	1.8	0.083	0.037
850	6	1.0	17	2.0	54	0.49	8.2	0.37	0.16	9.3	8.6	1.4	0.064	0.028
		1.5	18	2.1	56	0.53	9.1	0.41	0.18	10.2	9.6	1.6	0.074	0.033
		2.0	19	2.2	59	0.57	9.9	0.45	0.20	11.0	10.8	1.9	0.084	0.038
950	7	1.0	19	1.9	56	0.52	8.2	0.36	0.16	10.3	9.7	1.5	0.067	0.030
		1.5	19	2.0	58	0.56	8.9	0.39	0.18	11.1	10.8	1.7	0.075	0.035
		2.0	20	2.1	61	0.60	9.4	0.42	0.19	12.0	11.9	1.9	0.083	0.038
1400-lb Mature Weight @ BCS=5														
900	5	1.0	18	2.0	53	0.48	8.5	0.38	0.17	9.4	8.5	1.5	0.068	0.030
		1.5	18	2.0	55	0.51	9.3	0.42	0.19	10.0	9.4	1.7	0.078	0.035
		2.0	19	2.1	57	0.55	10.1	0.46	0.21	10.9	10.5	1.9	0.088	0.040
1000	6	1.0	20	1.9	53	0.49	8.0	0.36	0.16	10.3	9.4	1.6	0.069	0.032
		1.5	20	2.0	56	0.52	8.9	0.40	0.18	11.2	10.6	1.8	0.080	0.037
		2.0	21	2.1	58	0.56	9.5	0.43	0.20	12.1	11.7	2.0	0.089	0.041
1100	7	1.0	21	1.9	55	0.52	8.0	0.35	0.17	11.3	10.6	1.6	0.072	0.034
		1.5	21	1.9	58	0.55	8.7	0.39	0.18	12.2	11.8	1.9	0.082	0.039
		2.0	22	2.0	60	0.59	9.3	0.41	0.20	13.2	13.0	2.0	0.091	0.043

^a Body Condition Score

^b Average Daily Gain

Table 3. Nutrient requirements of pregnant replacement heifers (continued).

Pregnant yearling replacement heifer, last 1/3 of pregnancy

Current Weight (lbs)	Current BCS (1-9)	ADG (lbs)	DM Intake (lbs/day)	% of BW	Diet Nutrient Density					Daily Nutrients per Animal									
					TDN (%DM)	NEM (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NEM (Mcal)	CP (lbs)	Ca (lb)	P (lb)					
1000-lb Mature Weight @ BCS=5																			
700	5	1.0	16	2.2	57	0.54	8.8	0.28	0.17	8.9	8.5	1.4	0.044	0.027					
		1.5	17	2.4	60	0.59	9.9	0.34	0.20	9.9	9.8	1.6	0.055	0.032					
		2.0	17	2.4	63	0.64	10.9	0.39	0.22	10.7	10.9	1.9	0.066	0.038					
800	6	1.0	17	2.1	55	0.52	8.8	0.28	0.17	9.4	8.8	1.5	0.047	0.029					
		1.5	18	2.3	60	0.59	9.4	0.32	0.19	10.9	10.8	1.7	0.058	0.034					
		2.0	19	2.4	63	0.64	10.2	0.36	0.21	11.9	12.0	1.9	0.067	0.039					
900	7	1.0	18	2.0	57	0.54	8.8	0.28	0.18	10.2	9.7	1.6	0.051	0.032					
		1.5	19	2.1	62	0.62	9.3	0.31	0.19	11.8	11.8	1.8	0.060	0.036					
		2.0	20	2.2	65	0.66	9.9	0.34	0.20	12.8	13.1	2.0	0.068	0.040					
1200-lb Mature Weight @ BCS=5																			
850	5	1.0	18	2.1	57	0.54	8.5	0.27	0.17	10.3	9.8	1.5	0.049	0.031					
		1.5	19	2.2	59	0.57	9.4	0.32	0.19	10.9	10.7	1.8	0.060	0.036					
		2.0	19	2.3	61	0.61	10.3	0.36	0.21	11.8	11.7	2.0	0.070	0.041					
950	6	1.0	19	2.0	55	0.52	8.4	0.27	0.17	10.6	10.0	1.6	0.052	0.033					
		1.5	20	2.2	59	0.58	9.1	0.31	0.19	12.1	11.8	1.9	0.063	0.039					
		2.0	21	2.2	62	0.62	9.8	0.34	0.20	13.0	13.0	2.1	0.072	0.043					
1050	7	1.0	20	1.9	57	0.54	8.5	0.27	0.18	11.4	10.9	1.7	0.055	0.036					
		1.5	21	2.0	61	0.60	9.1	0.30	0.19	12.9	12.8	1.9	0.065	0.040					
		2.0	22	2.1	63	0.64	9.6	0.33	0.20	13.8	14.0	2.1	0.073	0.044					
1400-lb Mature Weight @ BCS=5																			
1020	5	1.0	21	2.0	56	0.52	8.3	0.26	0.17	11.4	10.8	1.7	0.054	0.035					
		1.5	21	2.1	58	0.55	9.2	0.31	0.19	12.2	11.7	1.9	0.066	0.040					
		2.0	22	2.1	60	0.59	9.8	0.34	0.21	12.9	12.7	2.1	0.074	0.045					
1120	6	1.0	22	2.0	55	0.52	8.2	0.26	0.17	12.0	11.3	1.8	0.057	0.037					
		1.5	23	2.0	58	0.56	8.9	0.30	0.19	13.2	12.8	2.0	0.069	0.043					
		2.0	23	2.1	60	0.59	9.4	0.33	0.20	14.1	13.9	2.2	0.077	0.047					
1220	7	1.0	23	1.9	57	0.54	8.3	0.27	0.18	12.8	12.2	1.9	0.060	0.040					
		1.5	24	1.9	60	0.59	8.8	0.30	0.19	14.0	13.8	2.1	0.070	0.044					
		2.0	24	2.0	62	0.62	9.4	0.33	0.20	15.1	15.1	2.3	0.079	0.049					

Table 3. Nutrient requirements of pregnant replacement heifers (continued).

Lactating first-calf heifer, first 90 days after calving						Diet Nutrient Density						Daily Nutrients per Animal					
Current Weight (lbs)	Current BCS (1-9)	ADG (lbs)	DM Intake (lbs/day)	% of BW		TDN (%DM)	NEm (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NEm (Mcal)	CP (lbs)	Ca (lb)	P (lb)		
1000-lb Mature Weight @ BCS=5																	
700	5	0.0	19	2.7		59	0.58	10.1	0.27	0.19	11.0	10.8	1.9	0.051	0.035		
		0.5	20	2.9		64	0.65	12.0	0.36	0.23	12.9	13.1	2.4	0.072	0.046		
		1.0	22	3.1		68	0.70	13.5	0.42	0.26	14.7	15.4	2.9	0.091	0.057		
		0.0	20	2.6		60	0.59	9.7	0.26	0.18	12.2	12.0	2.0	0.054	0.037		
800	6	0.5	22	2.8		64	0.65	11.3	0.34	0.22	14.1	14.3	2.5	0.074	0.048		
		1.0	24	3.0		68	0.70	12.7	0.39	0.25	16.0	16.7	3.0	0.093	0.058		
		0.0	21	2.4		60	0.59	9.8	0.27	0.19	12.7	12.5	2.1	0.057	0.040		
900	7	0.5	23	2.6		66	0.67	11.2	0.33	0.22	15.1	15.6	2.6	0.077	0.050		
		1.0	25	2.7		70	0.73	12.4	0.38	0.24	17.1	18.0	3.1	0.094	0.060		
1200-lb Mature Weight @ BCS=5																	
850	5	0.0	21	2.5		59	0.57	9.7	0.27	0.19	12.3	12.0	2.0	0.057	0.039		
		0.5	23	2.7		62	0.62	11.3	0.34	0.22	14.1	14.1	2.6	0.076	0.049		
		1.0	24	2.9		66	0.68	12.8	0.40	0.25	16.1	16.6	3.1	0.097	0.061		
		0.0	23	2.4		59	0.57	9.3	0.26	0.18	13.3	12.9	2.1	0.059	0.041		
950	6	0.5	25	2.6		63	0.63	10.9	0.32	0.21	15.3	15.4	2.7	0.079	0.052		
		1.0	26	2.7		66	0.68	12.1	0.37	0.24	17.2	17.8	3.2	0.098	0.062		
		0.0	24	2.2		61	0.60	9.4	0.26	0.18	14.3	14.2	2.2	0.062	0.043		
1050	7	0.5	25	2.4		65	0.66	10.8	0.32	0.21	16.3	16.7	2.7	0.082	0.054		
		1.0	27	2.6		68	0.71	11.9	0.37	0.24	18.3	19.1	3.2	0.099	0.064		
1400-lb Mature Weight @ BCS=5																	
1020	5	0.0	24	2.3		58	0.55	9.3	0.26	0.18	13.5	13.1	2.2	0.061	0.043		
		0.5	25	2.5		61	0.61	10.8	0.32	0.21	15.4	15.4	2.7	0.082	0.054		
		1.0	27	2.6		65	0.66	12.1	0.38	0.24	17.4	17.8	3.3	0.102	0.065		
		0.0	25	2.3		58	0.56	9.0	0.25	0.18	14.6	14.2	2.3	0.064	0.045		
1120	6	0.5	27	2.4		62	0.62	10.4	0.31	0.21	16.6	16.6	2.8	0.084	0.056		
		1.0	29	2.6		65	0.66	11.6	0.36	0.23	18.6	19.1	3.3	0.103	0.066		
		0.0	27	2.2		62	0.62	9.8	0.28	0.20	16.7	16.7	2.7	0.077	0.053		
1220	7	0.5	29	2.4		65	0.67	11.1	0.34	0.22	18.8	19.3	3.2	0.097	0.064		
		1.0	30	2.5		68	0.72	12.1	0.38	0.24	20.8	21.8	3.7	0.115	0.074		

Table 4. Nutrient requirements of growing steer and heifer calves.

Body Weight (lbs)	ADG (lbs)	DM Intake (lbs/day)	Diet Nutrient Density						Daily Nutrients per Animal																
			TDN (%DM)	NEEm (Mcal/lb)	NEg (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NEEm (Mcal)	NEg (Mcal)	CP (lbs)	Ca (lb)	P (lb)											
1100 lbs @ Finishing																									
	0.5	7.9	54	0.50	0.24	9.2	0.30	0.16	4.3	3.1	0.42	0.73	0.02	0.01											
	1.0	8.4	59	0.57	0.31	11.4	0.46	0.23	5.0	3.1	0.90	0.95	0.04	0.02											
300	1.5	8.6	64	0.64	0.37	13.6	0.62	0.29	5.5	3.1	1.40	1.17	0.05	0.03											
	2.0	8.6	69	0.72	0.44	16.2	0.79	0.36	5.9	3.1	1.92	1.39	0.07	0.03											
	2.5	8.5	75	0.81	0.52	18.9	0.96	0.40	6.4	3.1	2.46	1.61	0.08	0.03											
	3.0	8.2	83	0.92	0.62	22.2	1.17	0.51	6.8	3.1	3.00	1.83	0.10	0.04											
	0.5	9.8	54	0.50	0.24	8.7	0.27	0.15	5.3	3.8	0.52	0.85	0.03	0.02											
	1.0	10.4	59	0.57	0.31	10.4	0.39	0.20	6.1	3.8	1.12	1.08	0.04	0.02											
400	1.5	10.7	64	0.64	0.37	12.1	0.50	0.24	6.8	3.8	1.74	1.30	0.05	0.03											
	2.0	10.7	69	0.72	0.44	14.1	0.62	0.29	7.4	3.8	2.39	1.51	0.07	0.03											
	2.5	10.6	75	0.81	0.52	16.3	0.75	0.34	8.0	3.8	3.50	1.72	0.08	0.04											
	3.0	10.2	83	0.92	0.62	19.0	0.90	0.41	8.5	3.8	3.72	1.94	0.09	0.04											
	0.5	11.6	54	0.50	0.24	8.4	0.25	0.15	6.3	4.5	0.62	0.97	0.03	0.02											
	1.0	12.2	59	0.57	0.31	9.8	0.34	0.18	7.2	4.5	1.32	1.19	0.04	0.02											
500	1.5	12.6	64	0.64	0.37	11.2	0.42	0.22	8.1	4.5	2.06	1.41	0.05	0.03											
	2.0	12.7	69	0.72	0.44	12.8	0.52	0.25	8.8	4.5	2.82	1.63	0.07	0.03											
	2.5	12.5	75	0.81	0.52	14.7	0.62	0.30	9.4	4.5	3.60	1.84	0.08	0.04											
	3.0	12.1	83	0.92	0.62	16.9	0.74	0.35	10.0	4.5	4.40	2.05	0.09	0.04											
	0.5	13.2	54	0.50	0.24	8.2	0.23	0.14	7.1	5.2	0.71	1.08	0.03	0.02											
	1.0	14.0	59	0.57	0.31	9.4	0.30	0.17	8.3	5.2	1.51	1.31	0.04	0.02											
600	1.5	14.4	64	0.64	0.37	10.6	0.38	0.20	9.2	5.2	2.36	1.53	0.05	0.03											
	2.0	14.6	69	0.72	0.44	11.9	0.44	0.22	10.1	5.2	3.23	1.74	0.07	0.03											
	2.5	14.4	75	0.81	0.52	13.6	0.52	0.26	10.8	5.2	4.13	1.95	0.08	0.04											
	3.0	13.8	83	0.92	0.62	15.7	0.62	0.30	11.5	5.2	5.04	2.17	0.09	0.04											
	0.5	14.9	54	0.50	0.24	8.0	0.22	0.14	8.0	5.8	0.79	1.19	0.03	0.02											
	1.0	15.8	59	0.57	0.31	9.0	0.28	0.16	9.3	5.8	1.70	1.42	0.04	0.03											
700	1.5	16.2	64	0.64	0.37	10.1	0.33	0.19	10.4	5.8	2.65	1.64	0.05	0.03											
	2.0	16.3	69	0.72	0.44	11.4	0.39	0.21	11.2	5.8	3.63	1.85	0.06	0.03											
	2.5	16.1	75	0.81	0.52	12.8	0.46	0.24	12.1	5.8	4.64	2.06	0.07	0.04											
	3.0	15.5	83	0.92	0.62	14.6	0.54	0.27	12.9	5.8	5.66	2.27	0.08	0.04											

Table 4. Nutrient requirements of growing steer and heifer calves (continued).

Body Weight (lbs)	ADG (lbs)	DM Intake (lbs/day)	Diet Nutrient Density							Daily Nutrients per Animal										
			TDN (%DM)	NE _m (Mcal/lb)	NE _g (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NE _m (Mcal)	NE _g (Mcal)	CP (lbs)	Ca (lb)	P (lb)						
1200 lbs @ Finishing																				
	0.5	7.8	54	0.49	0.24	9.4	0.31	0.17	4.2	3.1	0.39	0.73	0.03	0.01						
	1.0	8.3	58	0.56	0.30	11.5	0.48	0.23	4.8	3.1	0.84	0.95	0.04	0.02						
300	1.5	8.6	63	0.63	0.36	13.7	0.63	0.29	5.4	3.1	1.31	1.17	0.05	0.03						
	2.0	8.6	68	0.70	0.42	16.2	0.80	0.36	5.8	3.1	1.80	1.40	0.07	0.03						
	2.5	8.6	73	0.78	0.50	18.7	0.96	0.43	6.3	3.1	2.30	1.61	0.08	0.04						
	3.0	8.3	80	0.88	0.58	22.0	1.18	0.52	6.6	3.1	2.81	1.83	0.10	0.04						
	0.5	9.7	54	0.49	0.24	8.8	0.28	0.16	5.2	3.8	0.49	0.85	0.03	0.02						
	1.0	10.3	58	0.56	0.30	10.4	0.39	0.20	6.0	3.8	1.04	1.07	0.04	0.02						
400	1.5	10.6	63	0.63	0.36	12.2	0.51	0.25	6.7	3.8	1.63	1.30	0.05	0.03						
	2.0	10.7	68	0.70	0.42	14.1	0.63	0.30	7.3	3.8	2.23	1.51	0.07	0.03						
	2.5	10.7	73	0.78	0.50	16.1	0.76	0.35	7.8	3.8	2.85	1.72	0.08	0.04						
	3.0	10.4	80	0.88	0.58	18.7	0.90	0.41	8.3	3.8	3.49	1.94	0.09	0.04						
	0.5	11.5	54	0.49	0.24	8.4	0.25	0.15	6.2	4.5	0.58	0.97	0.03	0.02						
	1.0	12.2	58	0.56	0.30	9.8	0.34	0.18	7.1	4.5	1.23	1.19	0.04	0.02						
500	1.5	12.6	63	0.63	0.36	11.2	0.43	0.22	7.9	4.5	1.93	1.41	0.06	0.03						
	2.0	12.6	68	0.70	0.42	12.9	0.53	0.26	8.6	4.5	2.64	1.63	0.07	0.03						
	2.5	12.6	73	0.78	0.50	14.6	0.63	0.30	9.2	4.5	3.37	1.84	0.08	0.04						
	3.0	12.2	80	0.88	0.58	16.8	0.75	0.35	9.8	4.5	4.12	2.05	0.09	0.04						
	0.5	13.2	54	0.49	0.24	8.2	0.24	0.15	7.1	5.2	0.66	1.08	0.03	0.02						
	1.0	14.0	58	0.56	0.30	9.3	0.31	0.17	8.1	5.2	1.42	1.31	0.04	0.02						
600	1.5	14.4	63	0.63	0.36	10.6	0.38	0.20	9.1	5.2	2.21	1.52	0.06	0.03						
	2.0	14.4	68	0.70	0.42	12.1	0.46	0.23	9.8	5.2	3.03	1.74	0.07	0.03						
	2.5	14.4	73	0.78	0.50	13.5	0.54	0.26	10.5	5.2	3.87	1.95	0.08	0.04						
	3.0	14.0	80	0.88	0.58	15.4	0.64	0.31	11.2	5.2	4.73	2.16	0.09	0.04						
	0.5	14.8	54	0.49	0.24	8.0	0.23	0.14	8.0	5.8	0.74	1.18	0.03	0.02						
	1.0	15.7	58	0.56	0.30	9.0	0.29	0.17	9.1	5.8	1.59	1.42	0.05	0.03						
700	1.5	16.2	63	0.63	0.36	10.1	0.34	0.19	10.2	5.8	2.48	1.64	0.06	0.03						
	2.0	16.3	68	0.70	0.42	11.3	0.41	0.21	11.1	5.8	3.40	1.85	0.07	0.04						
	2.5	16.2	73	0.78	0.50	12.7	0.47	0.24	11.8	5.8	4.34	2.05	0.08	0.04						
	3.0	15.8	80	0.88	0.58	14.4	0.55	0.27	12.6	5.8	5.30	2.27	0.09	0.04						

Table 5. Nutrient requirements of growing yearlings.

Body Weight (lbs)	ADG (lbs)	DM Intake (lbs/day)	Diet Nutrient Density						Daily Nutrients per Animal															
			TDN (%DM)	NEEm (Mcal/lb)	NEg (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NEEm (Mcal)	NEg (Mcal)	CP (lbs)	Ca (lb)	P (lb)										
1000 lbs @ Finishing																								
	0.6	15.2	50	0.45	0.20	7.1	0.21	0.13	7.6	4.8	0.9	1.1	0.03	0.02										
	1.8	16.1	60	0.61	0.35	9.8	0.36	0.19	9.7	4.8	2.9	1.6	0.06	0.03										
550	2.7	15.7	70	0.76	0.48	12.4	0.49	0.24	11.0	4.8	4.5	2.0	0.08	0.04										
	3.3	14.8	80	0.90	0.61	14.9	0.61	0.29	11.8	4.8	5.7	2.2	0.09	0.04										
	3.8	13.7	90	1.04	0.72	17.3	0.73	0.34	12.3	4.8	6.5	2.4	0.10	0.05										
	0.6	16.2	50	0.45	0.20	7.0	0.21	0.13	8.1	5.2	1.0	1.1	0.03	0.02										
	1.8	17.2	60	0.61	0.35	9.5	0.34	0.18	10.3	5.2	3.0	1.6	0.06	0.03										
600	2.7	16.8	70	0.76	0.48	11.9	0.45	0.23	11.8	5.2	4.8	2.0	0.08	0.04										
	3.3	15.8	80	0.90	0.61	14.3	0.56	0.27	12.6	5.2	6.1	2.3	0.09	0.04										
	3.8	14.6	90	1.04	0.72	16.5	0.66	0.32	13.1	5.2	6.9	2.4	0.10	0.05										
	0.6	17.3	50	0.45	0.20	6.9	0.20	0.12	8.7	5.5	1.1	1.2	0.04	0.02										
	1.8	18.2	60	0.61	0.35	9.2	0.32	0.17	10.9	5.5	3.2	1.7	0.06	0.03										
650	2.7	17.8	70	0.76	0.48	11.5	0.42	0.21	12.5	5.5	5.1	2.1	0.08	0.04										
	3.3	16.8	80	0.90	0.61	13.7	0.52	0.26	13.4	5.5	6.5	2.3	0.09	0.04										
	3.8	15.5	90	1.04	0.72	15.9	0.61	0.30	14.0	5.5	7.4	2.5	0.10	0.05										
	0.6	18.2	50	0.45	0.20	6.8	0.19	0.12	9.1	5.8	1.1	1.2	0.04	0.02										
	1.8	19.3	60	0.61	0.35	8.8	0.30	0.16	11.6	5.8	3.4	1.7	0.06	0.03										
700	2.7	18.8	70	0.76	0.48	10.9	0.39	0.20	13.2	5.8	5.4	2.1	0.07	0.04										
	3.3	17.8	80	0.90	0.61	13.0	0.48	0.24	14.2	5.8	6.8	2.3	0.09	0.04										
	3.8	16.4	90	1.04	0.72	15.0	0.56	0.28	14.8	5.8	7.8	2.5	0.09	0.05										
	0.6	19.2	50	0.45	0.20	6.7	0.19	0.12	9.6	6.1	1.2	1.3	0.04	0.02										
	1.8	20.3	60	0.61	0.35	8.5	0.28	0.16	12.2	6.1	3.6	1.7	0.06	0.03										
750	2.7	19.8	70	0.76	0.48	10.3	0.37	0.19	13.9	6.1	5.7	2.0	0.07	0.04										
	3.3	18.7	80	0.90	0.61	12.2	0.45	0.23	15.0	6.1	7.2	2.3	0.08	0.04										
	3.8	17.3	90	1.04	0.72	14.0	0.52	0.26	15.6	6.1	8.2	2.4	0.09	0.05										
	0.6	20.2	50	0.45	0.20	6.5	0.19	0.12	10.1	6.4	1.2	1.3	0.04	0.02										
	1.8	21.3	60	0.61	0.35	8.1	0.27	0.15	12.8	6.4	3.8	1.7	0.06	0.03										
800	2.7	20.8	70	0.76	0.48	9.8	0.34	0.18	14.6	6.4	5.9	2.0	0.07	0.04										
	3.3	19.6	80	0.90	0.61	11.5	0.42	0.22	15.7	6.4	7.6	2.3	0.08	0.04										
	3.8	18.1	90	1.04	0.72	13.2	0.48	0.25	16.3	6.4	8.6	2.4	0.09	0.05										

Table 5. Nutrient requirements of growing yearlings (continued).

Body Weight (lbs)	ADG (lbs)	DM Intake (lbs/day)	Diet Nutrient Density						Daily Nutrients per Animal																
			TDN (%DM)	NEM (Mcal/lb)	NEg (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NEM (Mcal)	NEg (Mcal)	CP (lbs)	Ca (lb)	P (lb)											
1100 lbs @ Finishing																									
	0.7	16.3	50	0.45	0.20	7.2	0.22	0.13	8.2	5.2	1.0	1.2	0.04	0.02											
	1.9	17.3	60	0.61	0.35	10.0	0.36	0.19	10.4	5.2	3.0	1.7	0.06	0.03											
605	2.9	16.9	70	0.76	0.48	12.7	0.49	0.24	11.8	5.2	4.8	2.2	0.08	0.04											
	3.6	15.9	80	0.90	0.61	15.3	0.61	0.29	12.7	5.2	6.1	2.4	0.10	0.05											
	4.0	14.7	90	1.04	0.72	17.8	0.72	0.34	13.2	5.2	7.0	2.6	0.11	0.05											
	0.7	17.5	50	0.45	0.20	7.1	0.21	0.13	8.8	5.5	1.1	1.2	0.04	0.02											
	1.9	18.4	60	0.61	0.35	9.7	0.34	0.18	11.0	5.5	3.2	1.8	0.06	0.03											
660	2.9	18.0	70	0.76	0.48	12.3	0.45	0.23	12.6	5.5	5.1	2.2	0.08	0.04											
	3.6	17.0	80	0.90	0.61	14.7	0.56	0.27	13.6	5.5	6.5	2.5	0.10	0.05											
	4.0	15.7	90	1.04	0.72	17.1	0.66	0.32	14.1	5.5	7.4	2.7	0.10	0.05											
	0.7	18.5	50	0.45	0.20	6.9	0.20	0.13	9.3	5.9	1.1	1.3	0.04	0.02											
	1.9	19.6	60	0.61	0.35	9.2	0.32	0.17	11.8	5.9	3.5	1.8	0.06	0.03											
715	2.9	19.1	70	0.76	0.48	11.5	0.42	0.21	13.4	5.9	5.5	2.2	0.08	0.04											
	3.6	18.1	80	0.90	0.61	13.7	0.52	0.26	14.5	5.9	6.9	2.5	0.09	0.05											
	4.0	16.7	90	1.04	0.72	15.9	0.61	0.30	15.0	5.9	7.9	2.7	0.10	0.05											
	0.7	19.6	50	0.45	0.20	6.8	0.20	0.12	9.8	6.2	1.2	1.3	0.04	0.02											
	1.9	20.7	60	0.61	0.35	8.8	0.30	0.16	12.4	6.2	3.6	1.8	0.06	0.03											
770	2.9	20.2	70	0.76	0.48	10.9	0.39	0.20	14.1	6.2	5.8	2.2	0.08	0.04											
	3.6	19.1	80	0.90	0.61	12.9	0.48	0.24	15.3	6.2	7.3	2.5	0.09	0.05											
	4.0	17.6	90	1.04	0.72	14.8	0.56	0.28	15.8	6.2	8.3	2.6	0.10	0.05											
	0.7	20.6	50	0.45	0.20	6.6	0.19	0.12	10.3	6.6	1.3	1.4	0.04	0.03											
	1.9	21.8	60	0.61	0.35	8.4	0.28	0.16	13.1	6.6	3.8	1.8	0.06	0.04											
825	2.9	21.3	70	0.76	0.48	10.3	0.37	0.19	14.9	6.6	6.1	2.2	0.08	0.04											
	3.6	20.1	80	0.90	0.61	12.1	0.44	0.23	16.1	6.6	7.7	2.4	0.09	0.05											
	4.0	18.6	90	1.04	0.72	13.9	0.52	0.26	16.7	6.6	8.8	2.6	0.10	0.05											
	0.7	21.7	50	0.45	0.20	6.5	0.19	0.12	10.9	6.9	1.3	1.4	0.04	0.03											
	1.9	22.9	60	0.61	0.35	8.1	0.27	0.15	13.7	6.9	4.0	1.9	0.06	0.03											
880	2.9	22.4	70	0.76	0.48	9.8	0.34	0.18	15.7	6.9	6.4	2.2	0.08	0.04											
	3.6	21.1	80	0.90	0.61	11.4	0.42	0.22	16.9	6.9	8.1	2.4	0.09	0.05											
	4.0	19.5	90	1.04	0.72	13.1	0.48	0.25	17.6	6.9	9.2	2.6	0.09	0.05											

Table 5. Nutrient requirements of growing yearlings (continued).

Body Weight (lbs)	ADG (lbs)	DM Intake (lbs/day)	Diet Nutrient Density								Daily Nutrients per Animal															
			TDN (%DM)	NEEm (Mcal/lb)	NEg (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NEEm (Mcal)	NEg (Mcal)	CP (lbs)	Ca (lb)	P (lb)												
1200 lbs @ Finishing																										
	0.7	17.5	50	0.45	0.20	7.3	0.22	0.13				8.8	5.5	1.1	1.3	0.04	0.02									
	2.0	18.4	60	0.61	0.35	10.2	0.36	0.19				11.0	5.5	3.3	1.9	0.07	0.04									
660	3.0	18.0	70	0.76	0.48	13.0	0.49	0.24				12.6	5.5	5.2	2.3	0.09	0.04									
	3.8	17.0	80	0.90	0.61	15.8	0.61	0.29				13.6	5.5	6.5	2.7	0.10	0.05									
	4.2	15.7	90	1.04	0.72	18.4	0.72	0.34				14.1	5.5	7.4	2.9	0.11	0.05									
	0.7	18.6	50	0.45	0.20	7.1	0.21	0.13				9.3	5.9	1.1	1.3	0.04	0.02									
	2.0	19.7	60	0.61	0.35	9.7	0.34	0.18				11.8	5.9	3.5	1.9	0.07	0.04									
720	3.0	19.2	70	0.76	0.48	12.2	0.45	0.23				13.4	5.9	5.5	2.3	0.09	0.04									
	3.8	18.2	80	0.90	0.61	14.6	0.56	0.27				14.6	5.9	7.0	2.7	0.10	0.05									
	4.2	16.8	90	1.04	0.72	17.0	0.66	0.32				15.1	5.9	7.9	2.9	0.11	0.05									
	0.7	19.8	50	0.45	0.20	6.9	0.20	0.13				9.9	6.3	1.2	1.4	0.04	0.03									
	2.0	20.9	60	0.61	0.35	9.2	0.32	0.17				12.5	6.3	3.7	1.9	0.07	0.04									
780	3.0	20.4	70	0.76	0.48	11.4	0.42	0.21				14.3	6.3	5.8	2.3	0.09	0.04									
	3.8	19.3	80	0.90	0.61	13.6	0.52	0.26				15.4	6.3	7.4	2.6	0.10	0.05									
	4.2	17.8	90	1.04	0.72	15.8	0.61	0.30				16.0	6.3	8.4	2.8	0.11	0.05									
	0.7	20.9	50	0.45	0.20	6.8	0.20	0.13				10.5	6.6	1.3	1.4	0.04	0.03									
	2.0	22.1	60	0.61	0.35	8.8	0.30	0.16				13.3	6.6	3.9	1.9	0.07	0.04									
840	3.0	21.6	70	0.76	0.48	10.8	0.39	0.20				15.1	6.6	6.2	2.3	0.09	0.04									
	3.8	20.4	80	0.90	0.61	12.8	0.48	0.24				16.3	6.6	7.8	2.6	0.10	0.05									
	4.2	18.8	90	1.04	0.72	14.7	0.56	0.28				16.9	6.6	8.9	2.8	0.12	0.05									
	0.7	22.0	50	0.45	0.20	6.6	0.19	0.12				11.0	7.0	1.3	1.5	0.04	0.03									
	2.0	23.3	60	0.61	0.35	8.4	0.28	0.16				14.0	7.0	4.1	2.0	0.06	0.04									
900	3.0	22.7	70	0.76	0.48	10.2	0.37	0.19				15.9	7.0	6.5	2.3	0.08	0.04									
	3.8	21.5	80	0.90	0.61	12.0	0.44	0.23				17.2	7.0	8.3	2.6	0.10	0.05									
	4.2	19.8	90	1.04	0.72	13.8	0.52	0.26				17.8	7.0	9.4	2.7	0.10	0.05									
	0.7	23.1	50	0.45	0.20	6.5	0.19	0.12				11.6	7.3	1.4	1.5	0.04	0.03									
	2.0	24.4	60	0.61	0.35	8.1	0.27	0.15				14.6	7.3	4.3	2.0	0.07	0.04									
960	3.0	23.9	70	0.76	0.48	9.7	0.34	0.19				16.7	7.3	6.8	2.3	0.08	0.05									
	3.8	22.5	80	0.90	0.61	11.3	0.41	0.22				18.0	7.3	8.7	2.5	0.09	0.05									
	4.2	20.8	90	1.04	0.72	13.0	0.48	0.25				18.7	7.3	9.9	2.7	0.10	0.05									

Table 5. Nutrient requirements of growing yearlings (continued).

Body Weight (lbs)	ADG (lbs)	DM Intake (lbs/day)	Diet Nutrient Density							Daily Nutrients per Animal						
			TDN (%DM)	NEM (Mcal/lb)	NEg (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NEM (Mcal)	NEg (Mcal)	CP (lbs)	Ca (lb)	P (lb)		
1300 lbs @ Finishing			50	0.45	0.20	7.3	0.22	0.13	9.3	5.9	1.1	1.4	0.04	0.02		
715	0.8	18.5	60	0.61	0.35	10.2	0.36	0.19	11.8	5.9	3.5	2.0	0.07	0.04		
	3.2	19.1	70	0.76	0.48	13.0	0.49	0.24	13.4	5.9	5.5	2.5	0.09	0.05		
	4.0	18.1	80	0.90	0.61	15.7	0.61	0.29	14.5	5.9	6.9	2.8	0.11	0.05		
	4.5	16.7	90	1.04	0.72	18.3	0.72	0.34	15.0	5.9	7.9	3.1	0.12	0.06		
	0.8	19.8	50	0.45	0.20	7.1	0.21	0.13	9.9	6.3	1.2	1.4	0.04	0.03		
780	2.1	20.9	60	0.61	0.35	9.6	0.34	0.18	12.5	6.3	3.7	2.0	0.07	0.04		
	3.2	20.4	70	0.76	0.48	12.1	0.45	0.23	14.3	6.3	5.8	2.5	0.09	0.05		
	4.0	19.3	80	0.90	0.61	14.5	0.56	0.27	15.4	6.3	7.4	2.8	0.11	0.05		
	4.5	17.8	90	1.04	0.72	16.9	0.66	0.32	16.0	6.3	8.4	3.0	0.12	0.06		
	0.8	21.0	50	0.45	0.20	6.9	0.21	0.13	10.5	6.7	1.3	1.5	0.04	0.03		
845	2.1	22.2	60	0.61	0.35	9.1	0.32	0.17	13.3	6.7	3.9	2.0	0.07	0.04		
	3.2	21.7	70	0.76	0.48	11.4	0.42	0.22	15.2	6.7	6.2	2.5	0.09	0.05		
	4.0	20.5	80	0.90	0.61	13.6	0.51	0.26	16.4	6.7	7.9	2.8	0.11	0.05		
	4.5	18.9	90	1.04	0.72	15.7	0.60	0.30	17.0	6.7	8.9	3.0	0.11	0.06		
	0.8	22.2	50	0.45	0.20	6.7	0.20	0.13	11.1	7.1	1.4	1.5	0.04	0.03		
910	2.1	23.5	60	0.61	0.35	8.7	0.30	0.17	14.1	7.1	4.1	2.0	0.07	0.04		
	3.2	22.9	70	0.76	0.48	10.7	0.39	0.20	16.0	7.1	6.6	2.5	0.09	0.05		
	4.0	21.6	80	0.90	0.61	12.7	0.48	0.24	17.3	7.1	8.3	2.7	0.10	0.05		
	4.5	20.0	90	1.04	0.72	14.6	0.56	0.28	18.0	7.1	9.4	3.0	0.11	0.06		
	0.8	23.4	50	0.45	0.20	6.6	0.20	0.13	11.7	7.4	1.4	1.5	0.05	0.03		
975	2.1	24.7	60	0.61	0.35	8.3	0.28	0.16	14.8	7.4	4.4	2.1	0.07	0.04		
	3.2	24.1	70	0.76	0.48	10.2	0.37	0.19	16.9	7.4	6.9	2.5	0.09	0.05		
	4.0	22.8	80	0.90	0.61	11.9	0.44	0.23	18.2	7.4	8.8	2.7	0.10	0.05		
	4.5	21.0	90	1.04	0.72	13.7	0.52	0.26	18.9	7.4	9.9	2.9	0.11	0.06		
	0.8	24.5	50	0.45	0.20	6.5	0.19	0.13	12.3	7.8	1.5	1.6	0.05	0.03		
1040	2.1	25.9	60	0.61	0.35	8.0	0.27	0.15	15.5	7.8	4.6	2.1	0.07	0.04		
	3.2	25.3	70	0.76	0.48	9.6	0.34	0.19	17.7	7.8	7.2	2.4	0.09	0.05		
	4.0	23.9	80	0.90	0.61	11.3	0.41	0.22	19.1	7.8	9.2	2.7	0.10	0.05		
	4.5	22.1	90	1.04	0.72	12.9	0.48	0.25	19.9	7.8	10.4	2.9	0.11	0.06		

Table 5. Nutrient requirements of growing yearlings (continued).

Body Weight (lbs)	Diet Nutrient Density					Daily Nutrients per Animal								
	ADG (lbs)	DM Intake (lbs/day)	TDN (%DM)	NEEm (Mcal/lb)	NEg (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NEEm (Mcal)	NEg (Mcal)	CP (lbs)	Ca (lb)	P (lb)
1400 lbs @ Finishing														
	0.8	19.6	50	0.45	0.20	7.3	0.22	0.13	9.8	6.2	1.2	1.4	0.04	0.03
	2.2	20.7	60	0.61	0.35	10.1	0.36	0.19	12.4	6.2	3.7	2.1	0.08	0.04
770	3.4	20.2	70	0.76	0.48	12.9	0.49	0.24	14.1	6.2	5.8	2.6	0.10	0.05
	4.2	19.1	80	0.90	0.61	15.6	0.61	0.29	15.3	6.2	7.3	3.0	0.12	0.06
	4.7	17.6	90	1.04	0.72	18.1	0.72	0.34	15.8	6.2	8.3	3.2	0.13	0.06
	0.8	20.9	50	0.45	0.20	7.1	0.21	0.13	10.5	6.6	1.3	1.5	0.04	0.03
	2.2	22.1	60	0.61	0.35	9.6	0.34	0.18	13.3	6.6	3.9	2.1	0.08	0.04
840	3.4	21.6	70	0.76	0.48	12.1	0.45	0.23	15.1	6.6	6.2	2.6	0.10	0.05
	4.2	20.4	80	0.90	0.61	14.5	0.56	0.27	16.3	6.6	7.8	3.0	0.11	0.06
	4.7	18.8	90	1.04	0.72	16.8	0.65	0.32	16.9	6.6	8.9	3.2	0.12	0.06
	0.8	22.2	50	0.45	0.20	6.9	0.21	0.13	11.1	7.1	1.4	1.5	0.05	0.03
	2.2	23.5	60	0.61	0.35	9.1	0.32	0.17	14.1	7.1	4.1	2.1	0.08	0.04
910	3.4	22.9	70	0.76	0.48	11.3	0.42	0.22	16.0	7.1	6.6	2.6	0.10	0.05
	4.2	21.6	80	0.90	0.61	13.5	0.51	0.26	17.3	7.1	8.3	2.9	0.11	0.06
	4.7	20.0	90	1.04	0.72	15.6	0.60	0.3	18.0	7.1	9.5	3.1	0.12	0.06
	0.8	23.5	50	0.45	0.20	6.7	0.20	0.13	11.8	7.5	1.4	1.6	0.05	0.03
	2.2	24.8	60	0.61	0.35	8.7	0.30	0.17	14.9	7.5	4.4	2.2	0.07	0.04
980	3.4	24.2	70	0.76	0.48	10.7	0.39	0.20	16.9	7.5	6.9	2.6	0.09	0.05
	4.2	22.9	80	0.90	0.61	12.6	0.47	0.24	18.3	7.5	8.8	2.9	0.11	0.06
	4.7	21.1	90	1.04	0.72	14.5	0.56	0.28	19.0	7.5	10.0	3.1	0.12	0.06
	0.8	24.7	50	0.45	0.20	6.6	0.20	0.13	12.4	7.9	1.5	1.6	0.05	0.03
	2.2	26.1	60	0.61	0.35	8.3	0.28	0.16	15.7	7.9	4.6	2.2	0.07	0.04
1050	3.4	25.5	70	0.76	0.48	10.1	0.37	0.20	17.9	7.9	7.3	2.6	0.09	0.05
	4.2	24.1	80	0.90	0.61	11.9	0.44	0.23	19.3	7.9	9.3	2.9	0.11	0.06
	4.7	22.2	90	1.04	0.72	13.6	0.51	0.26	20.0	7.9	10.5	3.0	0.11	0.06
	0.8	25.9	50	0.45	0.20	6.5	0.19	0.13	13.0	8.2	1.6	1.7	0.05	0.03
	2.2	27.4	60	0.61	0.35	8.0	0.27	0.16	16.4	8.2	4.8	2.2	0.07	0.04
1120	3.4	26.8	70	0.76	0.48	9.6	0.34	0.19	18.8	8.2	7.7	2.6	0.09	0.05
	4.2	25.3	80	0.90	0.61	11.2	0.41	0.22	20.2	8.2	9.7	2.8	0.10	0.06
	4.7	23.3	90	1.04	0.72	12.8	0.48	0.25	21.0	8.2	11.1	3.0	0.11	0.06

Table 6. Nutrient requirements of growing and mature bulls.

Body Weight (lbs)	ADG (lbs)	DM Intake (lbs/day)	Diet Nutrient Density							Daily Nutrients per Animal														
			TDN (%DM)	NEEm (Mcal/lb)	NEg (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NEEm (Mcal)	NEg (Mcal)	CP (lbs)	Ca (lb)	P (lb)										
1700-lb Mature Weight																								
	0.4	22	50	0.45	0.20	7.0	0.16	0.11	11.0	8.0	0.9	1.5	0.04	0.03										
900	1.6	23	60	0.61	0.35	7.3	0.23	0.14	14.0	8.0	3.5	1.7	0.05	0.03										
	2.5	23	70	0.76	0.48	8.8	0.30	0.16	15.9	8.0	5.8	2.0	0.07	0.04										
	3.1	22	80	0.90	0.61	10.2	0.36	0.19	17.2	8.0	7.6	2.2	0.08	0.04										
	0.4	24	50	0.45	0.20	7.0	0.16	0.11	11.9	8.7	1.0	1.7	0.04	0.03										
1000	1.6	25	60	0.61	0.35	7.0	0.22	0.13	15.1	8.7	3.8	1.8	0.06	0.03										
	2.5	25	70	0.76	0.48	8.1	0.27	0.15	17.2	8.7	6.3	2.0	0.07	0.04										
	3.1	23	80	0.90	0.61	9.3	0.32	0.18	18.6	8.7	8.2	2.2	0.07	0.04										
	0.4	26	50	0.45	0.20	7.0	0.16	0.11	12.8	9.4	1.0	1.8	0.04	0.03										
1100	1.6	27	60	0.61	0.35	7.0	0.20	0.13	16.2	9.4	4.1	1.9	0.06	0.03										
	2.5	26	70	0.76	0.48	7.5	0.25	0.14	18.5	9.4	6.8	2.0	0.07	0.04										
	3.1	25	80	0.90	0.61	8.6	0.29	0.16	19.9	9.4	8.8	2.1	0.07	0.04										
	0.4	27	50	0.45	0.20	7.0	0.16	0.11	13.7	10.0	1.1	1.9	0.04	0.03										
1200	1.6	29	60	0.61	0.35	7.0	0.19	0.12	17.3	10.0	4.4	2.0	0.06	0.04										
	2.5	28	70	0.76	0.48	7.1	0.23	0.14	19.7	10.0	7.2	2.0	0.06	0.04										
	3.1	27	80	0.90	0.61	7.9	0.26	0.15	21.3	10.0	9.4	2.1	0.07	0.04										
	0.4	29	50	0.45	0.20	7.0	0.16	0.11	14.5	10.6	1.2	2.0	0.05	0.03										
	1.6	31	60	0.61	0.35	7.0	0.19	0.12	18.4	10.6	4.6	2.2	0.06	0.04										
1400	0.4	31	50	0.45	0.20	7.0	0.16	0.11	15.4	11.2	1.2	2.2	0.05	0.04										
	1.6	32	60	0.61	0.35	7.0	0.18	0.12	19.4	11.2	4.9	2.3	0.06	0.04										
1500	0.4	32	50	0.45	0.20	7.0	0.16	0.11	16.2	11.8	1.3	2.3	0.05	0.04										
	1.6	34	60	0.61	0.35	7.0	0.17	0.12	20.5	11.8	5.1	2.4	0.06	0.04										
1600	0.4	34	50	0.45	0.20	7.0	0.16	0.12	17.0	12.4	1.4	2.4	0.05	0.04										
	1.6	36	60	0.61	0.35	7.0	0.16	0.11	21.5	12.4	5.4	2.5	0.06	0.04										
1700	0.0	33	46	0.39	0.00	7.0	0.16	0.12	15.1	13.0	0.0	2.3	0.05	0.04										
	0.4	36	50	0.45	0.20	7.0	0.16	0.12	17.8	13.0	1.4	2.5	0.06	0.04										

Table 6. Nutrient requirements of growing and mature bulls (continued).

Body Weight (lbs)	ADG (lbs)	DM Intake (lbs/day)	Diet Nutrient Density								Daily Nutrients per Animal											
			TDN (%DM)	NEEm (Mcal/lb)	NEg (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NEEm (Mcal)	NEg (Mcal)	CP (lbs)	Ca (lb)	P (lb)								
2000-lb Mature Weight											11.9	8.7	1.0	1.7	0.04	0.03	11.9	8.7	1.0	1.7	0.04	0.03
1000	0.5	24	50	0.45	0.20	7.0	0.17	0.12	0.12	0.14	15.1	8.7	3.8	1.9	0.06	0.04						
	1.7	25	60	0.61	0.35	7.5	0.25	0.14	0.14	0.17	17.2	8.7	6.3	2.2	0.08	0.04						
	2.8	25	70	0.76	0.48	9.1	0.32	0.17	0.17	0.20	18.6	8.7	8.2	2.4	0.09	0.05						
	3.5	23	80	0.90	0.61	10.5	0.38	0.20	0.20	0.20	12.8	9.4	1.0	1.8	0.04	0.03						
1100	0.5	26	50	0.45	0.20	7.0	0.17	0.12	0.12	0.14	16.2	9.4	4.1	1.9	0.06	0.04						
	1.7	27	60	0.61	0.35	7.1	0.23	0.14	0.14	0.16	18.5	9.4	6.8	2.2	0.08	0.04						
	2.8	26	70	0.76	0.48	8.4	0.29	0.16	0.16	0.19	19.9	9.4	8.8	2.4	0.09	0.05						
	3.5	25	80	0.90	0.61	9.8	0.35	0.19	0.19	0.20	13.7	10.0	1.1	1.9	0.05	0.03						
1200	0.5	27	50	0.45	0.20	7.0	0.17	0.12	0.12	0.13	17.3	10.0	4.3	2.0	0.06	0.04						
	1.7	29	60	0.61	0.35	7.0	0.22	0.13	0.13	0.16	19.7	10.0	7.2	2.2	0.08	0.04						
	2.8	28	70	0.76	0.48	7.9	0.27	0.16	0.16	0.18	21.3	10.0	9.4	2.4	0.08	0.05						
	3.5	27	80	0.90	0.61	9.0	0.32	0.18	0.18	0.18	14.5	10.6	1.2	2.0	0.05	0.03						
1300	0.5	29	50	0.45	0.20	7.0	0.17	0.12	0.12	0.13	18.4	10.6	4.6	2.2	0.06	0.04						
	1.7	31	60	0.61	0.35	7.0	0.21	0.13	0.13	0.15	21.0	10.6	7.7	2.2	0.07	0.04						
	2.8	30	70	0.76	0.48	7.4	0.25	0.15	0.15	0.17	22.6	10.6	10.0	2.4	0.08	0.05						
	3.5	28	80	0.90	0.61	8.4	0.29	0.17	0.17	0.17	15.4	11.2	1.2	2.2	0.05	0.04						
1400	0.5	31	50	0.45	0.20	7.0	0.16	0.12	0.12	0.13	19.4	11.2	4.9	2.3	0.06	0.04						
	1.7	32	60	0.61	0.35	7.0	0.20	0.13	0.13	0.16	16.2	11.8	1.3	2.3	0.05	0.04						
	2.8	32	70	0.76	0.48	7.0	0.25	0.13	0.13	0.16	20.5	11.8	5.1	2.4	0.07	0.04						
	3.5	34	80	0.90	0.61	8.4	0.32	0.17	0.17	0.17	17.0	12.4	1.4	2.4	0.06	0.04						
1500	0.5	34	50	0.45	0.20	7.0	0.17	0.12	0.12	0.12	21.5	12.4	5.4	2.5	0.07	0.04						
	1.7	36	60	0.61	0.35	7.0	0.18	0.12	0.12	0.12	17.8	13.0	1.4	2.5	0.06	0.04						
	2.8	36	70	0.76	0.48	7.0	0.21	0.12	0.12	0.12	22.5	13.0	5.6	2.6	0.07	0.05						
	3.5	38	80	0.90	0.61	8.4	0.29	0.12	0.12	0.12	18.5	13.5	1.5	2.6	0.06	0.04						
1600	0.5	37	50	0.45	0.20	7.0	0.16	0.12	0.12	0.12	23.5	13.5	5.9	2.7	0.07	0.05						
	1.7	39	60	0.61	0.35	7.0	0.17	0.12	0.12	0.12	19.3	14.1	1.5	2.7	0.06	0.05						
	2.8	39	70	0.76	0.48	7.0	0.20	0.12	0.12	0.12	24.5	14.1	6.1	2.9	0.07	0.05						
	3.5	41	80	0.90	0.61	8.4	0.32	0.12	0.12	0.12	17.1	14.6	0.0	2.6	0.06	0.05						
1700	0.5	37	50	0.45	0.20	7.0	0.16	0.12	0.12	0.13	20.1	14.6	1.6	2.8	0.07	0.05						
	1.7	39	60	0.61	0.35	7.0	0.17	0.12	0.12	0.13												
	2.8	39	70	0.76	0.48	7.0	0.20	0.12	0.12	0.13												
	3.5	41	80	0.90	0.61	8.4	0.32	0.12	0.12	0.13												
1800	0.5	37	50	0.45	0.20	7.0	0.16	0.12	0.12	0.13												
	1.7	39	60	0.61	0.35	7.0	0.17	0.12	0.12	0.13												
	2.8	39	70	0.76	0.48	7.0	0.20	0.12	0.12	0.13												
	3.5	41	80	0.90	0.61	8.4	0.32	0.12	0.12	0.13												
1900	0.5	37	50	0.45	0.20	7.0	0.16	0.12	0.12	0.13												
	1.7	37	60	0.61	0.35	7.0	0.17	0.12	0.12	0.13												
	2.8	37	70	0.76	0.48	7.0	0.20	0.12	0.12	0.13												
	3.5	40	80	0.90	0.61	8.4	0.32	0.12	0.12	0.13												
2000	0.0	37	46	0.39	0.00	7.0	0.17	0.13	0.13	0.12												
	0.5	40	50	0.45	0.20	7.0	0.16	0.12	0.12	0.12												

Table 6. Nutrient requirements of growing and mature bulls (continued).

Body Weight (lbs)	ADG (lbs)	DM Intake (lbs/day)	Diet Nutrient Density						Daily Nutrients per Animal															
			TDN (%DM)	NEM (Mcal/lb)	NEg (Mcal/lb)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NEM (Mcal)	NEg (Mcal)	CP (lbs)	Ca (lb)	P (lb)										
2300-lb Mature Weight																								
	0.5	27	50	0.45	0.20	7.0	0.18	0.12	13.7	10.0	1.1	1.9	0.05	0.03										
1200	1.9	29	60	0.61	0.35	7.3	0.24	0.14	17.3	10.0	4.4	2.1	0.07	0.04										
	3.0	28	70	0.76	0.48	8.7	0.30	0.17	19.7	10.0	7.2	2.5	0.09	0.05										
	3.8	27	80	0.90	0.61	10.1	0.36	0.20	21.3	10.0	9.4	2.7	0.10	0.05										
1300	0.5	29	50	0.45	0.20	7.0	0.17	0.12	14.5	10.6	1.2	2.0	0.05	0.04										
	1.9	31	60	0.61	0.35	7.0	0.23	0.14	18.4	10.6	4.6	2.2	0.07	0.04										
	3.0	30	70	0.76	0.48	8.2	0.28	0.16	21.0	10.6	7.7	2.5	0.09	0.05										
	3.8	28	80	0.90	0.61	9.4	0.34	0.19	22.6	10.6	10.0	2.7	0.10	0.05										
1400	0.5	31	50	0.45	0.20	7.0	0.17	0.12	15.4	11.2	1.2	2.2	0.05	0.04										
	1.9	32	60	0.61	0.35	7.0	0.22	0.14	19.4	11.2	4.9	2.3	0.07	0.04										
	3.0	32	70	0.76	0.48	7.7	0.26	0.15	22.2	11.2	8.1	2.4	0.08	0.05										
	3.8	30	80	0.90	0.61	8.8	0.31	0.18	23.9	11.2	12.5	2.6	0.09	0.05										
1500	0.5	32	50	0.45	0.20	7.0	0.17	0.12	16.2	11.8	1.3	2.3	0.06	0.04										
	1.9	34	60	0.61	0.35	7.0	0.21	0.13	20.5	11.8	5.2	2.4	0.07	0.05										
1600	0.5	34	50	0.45	0.20	7.0	0.17	0.12	17.0	12.4	1.4	2.4	0.06	0.04										
	1.9	36	60	0.61	0.35	7.0	0.20	0.13	21.5	12.4	5.4	2.5	0.07	0.05										
1700	0.5	36	50	0.45	0.20	7.0	0.17	0.12	17.8	13.0	1.4	2.5	0.06	0.04										
	1.9	38	60	0.61	0.35	7.0	0.19	0.13	22.5	13.0	5.7	2.6	0.07	0.05										
1800	0.5	37	50	0.45	0.20	7.0	0.17	0.12	18.5	13.5	1.5	2.6	0.06	0.05										
	1.9	39	60	0.61	0.35	7.0	0.19	0.13	23.5	13.5	5.9	2.7	0.07	0.05										
1900	0.5	39	50	0.45	0.20	7.0	0.17	0.12	19.3	14.1	1.5	2.7	0.07	0.05										
	1.9	41	60	0.61	0.35	7.0	0.18	0.13	24.5	14.1	6.2	2.9	0.08	0.05										
2000	0.5	40	50	0.45	0.20	7.0	0.17	0.12	20.1	14.6	1.6	2.8	0.07	0.05										
	1.9	42	60	0.61	0.35	7.0	0.18	0.13	25.4	14.6	6.4	3.0	0.08	0.05										
2100	0.5	42	50	0.45	0.20	7.0	0.17	0.13	20.8	15.2	1.7	2.9	0.07	0.05										
	1.9	44	60	0.61	0.35	7.0	0.17	0.12	26.3	15.2	6.6	3.1	0.08	0.05										
2200	0.5	43	50	0.45	0.20	7.0	0.17	0.13	21.6	15.7	1.7	3.0	0.07	0.05										
	1.9	46	60	0.61	0.35	7.0	0.17	0.12	27.3	15.7	6.9	3.2	0.08	0.06										
2300	0.0	45	46	0.39	0.00	7.0	0.16	0.12	20.5	16.3	0.0	3.1	0.07	0.05										
	0.5	47	50	0.45	0.20	7.0	0.16	0.12	23.5	16.3	1.8	3.3	0.08	0.06										

Table 7. Mineral requirements and maximum tolerable concentration and vitamin requirements.

Mineral/Vitamin	Unit	Growing and Finishing ^a	Cows		Maximum Tolerable Level
			Gestation	Early Lactation	
Magnesium	%	0.10	0.12	0.20	0.40
Potassium	%	0.60	0.60	0.70	3.00
Sodium	%	0.06-0.08	0.06-0.08	0.10	--
Sulfur	%	0.15	0.15	0.15	0.40
Cobalt	ppm	0.10	0.10	0.10	10.00
Copper	ppm	10.00	10.00	10.00	100.00
Iodine	ppm	0.50	0.50	0.50	50.00
Iron	ppm	50.00	50.00	50.00	1000.00
Manganese	ppm	20.00	40.00	40.00	1000.00
Selenium	ppm	0.10	0.10	0.10	2.00
Zinc	ppm	30.00	30.00	30.00	500.00
Vitamin A	IU/lb	1000.00	1300.00	1800.00	--
Vitamin D	IU/lb	125.00	125.00	125.00	--

a Also for breeding bulls.

Source: NRC.

Table 8. Approximate total daily water intake of beef cattle (gallons)^a.

Weight (lbs)	Temperature in °F ^b					
	40	50	60	70	80	90
Growing heifers, steers, and bulls						
400	4.0	4.3	5.0	5.8	6.7	9.5
600	5.3	5.8	6.6	7.8	8.9	12.7
800	6.3	6.8	7.9	9.2	10.6	15.0
Finishing cattle						
600	6.0	6.5	7.4	8.7	10.0	14.3
800	7.3	7.9	9.1	10.7	12.3	17.4
1000	8.7	9.4	10.8	12.6	14.5	20.6
Wintering pregnant cows ^c						
900	6.7	7.2	8.3	9.7	-	-
1100	6.0	6.5	7.4	8.7	-	-
Lactating cows ^d						
900	11.4	12.6	14.5	16.9	17.9	16.2
Mature bulls						
1400	8.0	8.6	9.9	11.7	13.4	19.0
1600+	8.7	9.4	10.8	12.6	14.5	20.6

a Adapted from NRC, 2000.

b Water intake of a given class of cattle in a specific management regime is a function of dry matter intake and ambient temperature. Water intake is quite constant up to 40°F.

c Dry matter intake has a major influence on water intake. Heavier cows are assumed to be higher in body condition and to require less dry matter, and thus, less water intake.

d Cows larger than 900 lbs are included in this recommendation.

