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SUBJECT: ECS – Nutrient Requirements of Beef Cattle

Purpose: To distribute information to the field.

Effective Date: Effective upon receipt.

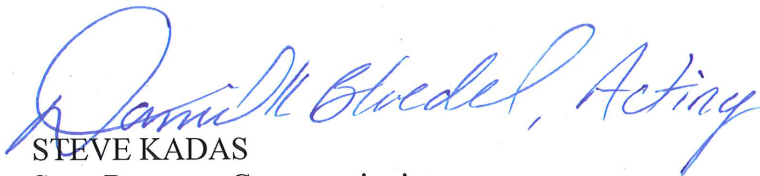
Filing Instructions: Technical notes are accessible online at the NRCS New Mexico Field Office Technical Guide website: <http://efotg.sc.egov.usda.gov/treemenuFS.aspx> , Section I.

Summary. To provide the publication *Nutrient Requirements of Beef Cattle* from David Lalman, Professor and Chris Richards, Associate Professor of Beef Cattle at Oklahoma Cooperative Extension Sciences and Natural Resources, Oklahoma State University.

Lalman and Richards included nutrient requirements for different cattle classes, ages and type, at different stages of the reproductive cycle based on the National Research Council of Domestic Animal (NRC) information. The one exception is that the NRC calculates the crude protein requirement for some classes of cattle to be less than 7 percent. Research demonstrates that ruminal fermentation may be compromised with low protein diets. Therefore, 7 percent dietary crude protein was the minimum value used in the nutrient requirements in Table 1. This same research is consistent with minimum crude protein levels as recommended by the Grazing Animal Nutrition Lab of Texas A&M and is utilized in the Nutritional Balance Analyzer (NUTBAL).

This publication will serve as the reference for Beef Cattle when the dietary needs from the National Research Council of Domestic Animal standard is required to compare protein and energy from forages/browse available to cattle.

If you encounter any problems or questions with the document provided, please contact your State Rangeland Management Specialist.



STEVE KADAS
State Resource Conservationist

Attachment

Nutrient Requirements of Beef Cattle

E-974



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Objectives

- Discuss the nutrient requirements of beef cattle.
- Provide tables that list the nutrient requirements of beef cattle.
- Explain how 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 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 pounds per day may require 1.6 pounds of protein per day. If they consume 15 pounds of DM daily, the protein requirement could be expressed as 10.7 percent of DM intake. On the other hand, if they are limit fed to consume only 10 pounds of DM daily, the protein requirement for 2 pounds of gain could be expressed as 16 percent of DM intake.

Intake in forage-fed cattle is generally limited by the forage capacity of the digestive tract. Values presented in Table 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 percent to 74 percent of DM. Calves and yearlings frequently are 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 70 percent, 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 1). This response can be thought of as a built-in safety mechanism so cattle are less likely to consume too much of a highly digestible diet, causing digestive upset, bloat and founder.

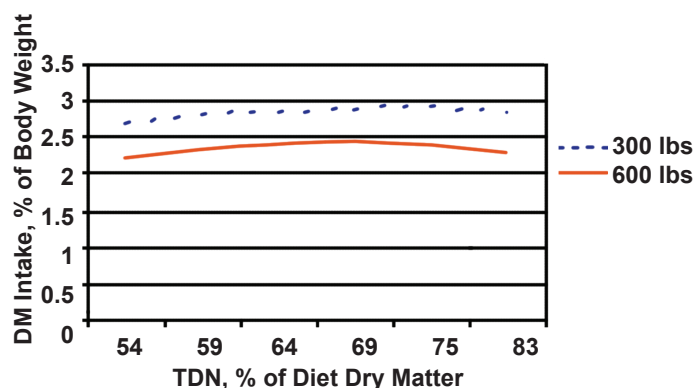


Figure 1. The relationship of diet digestibility to dry matter intake in growing calves. Source: NRC.

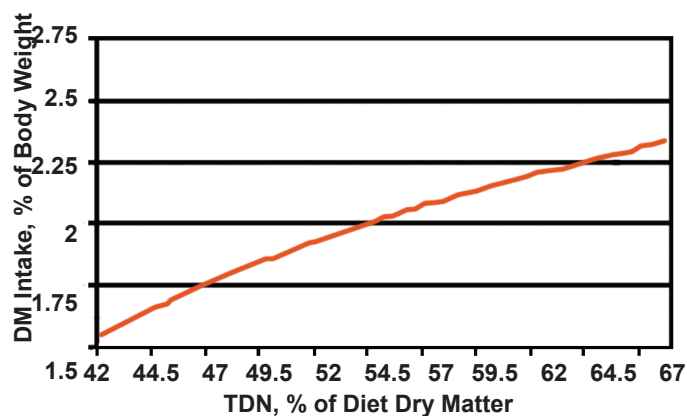


Figure 2. The relationship of forage digestibility to dry matter intake in beef cows. Source: NRC.

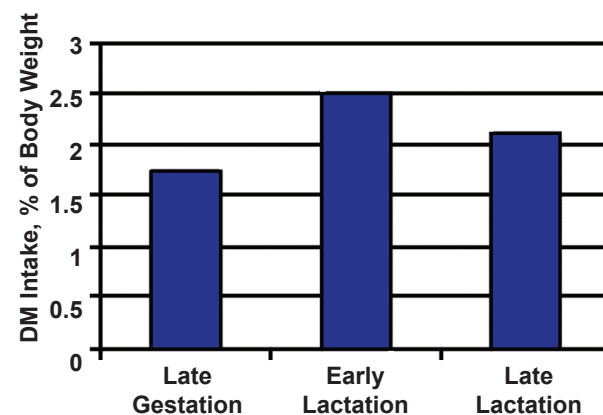


Figure 3. Dry matter intake, expressed as percent of body weight, of beef cows consuming low quality forage during three different stages of production. Source: Johnson et al.

Forage intake is highly correlated with forage quality as shown in Figure 2 and in Table 1. The more rapid rate of digestion and passage of higher quality forage results in considerably higher dry matter intake compared to forage lower in digestibility.

Cattle with greater mature body weight and frame size consume more forage compared to smaller frame cattle. Lactating cows consume considerably more of the same quality forage compared to gestating cows (Figure 3). Additionally, fleshy cattle

Table 1. Forage capacity of beef cows^a.

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

^a Intake estimates assume 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.

consume 3 to 10 percent 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, 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 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 all of these equations assume 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 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, 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) break down 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 makeup 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 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 percent 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. 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 used either 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).

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 1. 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

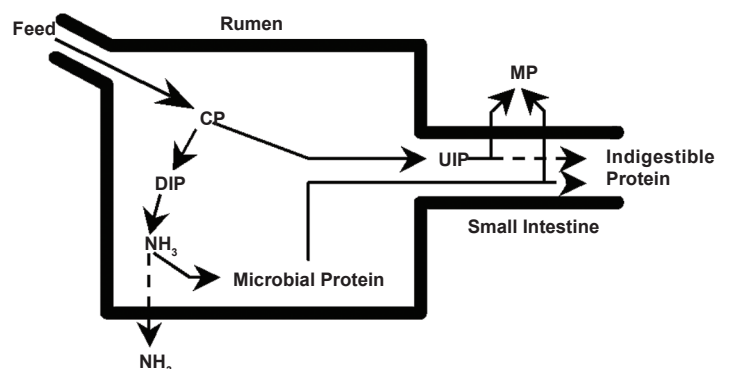


Figure 4. Illustration of protein digestion and absorption in the ruminant. Source: Lalman.

10 percent to 13 percent 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 percent concentrate. The UIP value of the feed can also be calculated by subtracting the DIP value from one.

An example of DIP requirement and supply is to assume a cow is consuming 25 pounds of hay dry matter that contains 50 percent TDN. The cow therefore consumes a total of 12.5 pounds of TDN per day. Therefore, the DIP requirement is 12.5 pounds x 10 percent, or 1.25 pounds of DIP per day. If the hay contains 6 percent CP (dry matter basis), of which 65 percent is DIP, this cow would consume 0.98 pound of DIP each day (6 percent x 65 percent x 25 pounds). The requirement for supplemental DIP would be 0.27 pound (0.98 pound to 1.25 pounds).

Nutrient requirements, including protein requirements, for beef cows and replacement heifers are shown in Tables 2 and 3. Requirements for growing calves and yearlings are shown in Tables 4 and 5. Requirements for growing and mature bulls are shown in Table 6. These values were adapted from the National Research Council's (NRC) 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 percent. Research demonstrates that ruminal fermentation may be compromised with low protein diets. Therefore, 7 percent dietary crude protein was the minimum value used in the nutrient requirements in Table 1.

The requirements are expressed in both pounds per day of crude protein and in terms of the percentage of dry matter required in the diet. 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 pound per day to 1.5 pound per day to reach 60 percent to 65 percent of their expected mature weight and puberty by 15 months of age. They also need to gain around 1 pound per day from the time they are bred until they calve to reach approximately 80 percent 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 two-thirds of the fetal growth occurs during the last one-third of pregnancy, and the protein intake of the cow should be increased during the last one-third of pregnancy to ensure 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 also is 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 25 pounds 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 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 pounds per day to 30 pounds per 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 requires 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 nitrogen from the protein molecule. When this occurs, protein is used as a very expensive energy source.

Energy requirements expressed in the following tables are 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 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 percent more TDN or net energy than 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-pound dry pregnant cow in the middle third of pregnancy requires 32 percent more TDN per day than a 900-pound 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 2 through 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 7).

Water

Cattle require a minimum amount of water, reflecting the water necessary for growth, fetal development, lactation, and re-placing water lost from urine, sweat, and evaporation. An adequate supply of clean, fresh water is a critical component of maintaining healthy, productive livestock. Additionally, knowledge of water needs for livestock is necessary when designing water-supply systems where the water supply may be limited or the delivery system restricts access to water during periods of heavy use. Water is necessary for the majority of life processes, including blood volume maintenance, regulation of temperature, growth, reproduction, lactation, and digestion. In fact, the body weight of mature cattle is about 50 percent water (Johnson et al. 2012). Primary factors known to influence water requirements include age, weight, stage of production, and environment. Estimated daily voluntary water intake is shown for growing and finishing cattle in Table 8 and for beef cows in Table 9.

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 shows a 1,200-pound cow subjected to 20 F in a 14 mph wind requires about 28 percent 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.

References

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- Johnson, C.R. et al. (2003) Influence of milk production potential on forage dry matter intake of Multiparous and primiparous Brangus females. *Journal of Animal Science* 81:1837-1846.
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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)	DM Intake % of BW	Diet Nutrient Density				Daily Nutrients per Animal				
				TDN (% DM)	NE _m (Mcal/lb) (% DM)	CP (% DM)	Ca (% DM)	P (% DM)	TDN (lbs)	NE _m (Mcal)	CP (lbs)	Ca (lb)
900	63	17	1.9	50	0.44	7.1	0.17	0.14	8.3	7.3	1.2	0.028
1,000	69	18	1.8	50	0.44	7.1	0.17	0.14	9.0	7.9	1.3	0.025
1,100	75	19	1.8	50	0.44	7.1	0.17	0.14	9.7	8.5	1.4	0.028
1,200	80	21	1.7	50	0.44	7.1	0.18	0.15	10.3	9.1	1.5	0.030
1,300	86	22	1.7	50	0.44	7.1	0.18	0.15	11.0	9.7	1.6	0.033
1,400	91	23	1.7	50	0.44	7.1	0.19	0.15	11.6	10.2	1.6	0.035
1,500	96	25	1.6	50	0.44	7.1	0.19	0.15	12.2	10.8	1.7	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	0.030
1,000	69	21	2.1	54	0.50	7.9	0.25	0.16	11.2	10.4	1.6	0.034
1,100	75	22	2.0	54	0.50	7.9	0.25	0.16	12.1	11.2	1.8	0.037
1,200	80	24	2.0	54	0.50	7.9	0.26	0.17	12.9	12.0	1.9	0.040
1,300	86	25	2.0	54	0.50	7.9	0.26	0.17	13.7	12.8	2.0	0.043
1,400	91	27	1.9	54	0.50	7.9	0.26	0.17	14.5	13.5	2.1	0.046
1,500	96	28	1.9	54	0.50	7.9	0.27	0.17	15.3	14.2	2.2	0.049
Lactating cow, first 90 days after calving												
Weight (lbs)	Peak Milk lbs/day	DM Intake (lbs/day)	DM Intake % of BW	Diet Nutrient Density				Daily Nutrients per Animal				
				TDN (%DM)	NE _m (Mcal/lb) (%DM)	CP (%DM)	Ca (%DM)	P (%DM)	TDN (lbs)	NE _m (Mcal)	CP (lbs)	Ca (lb)
900	10	22	2.5	56	0.53	8.7	0.24	0.17	12.4	11.7	1.9	0.052
15	15	24	2.7	57	0.55	9.6	0.27	0.18	13.7	13.3	2.3	0.065
20	20	26	2.9	59	0.58	10.4	0.30	0.20	15.3	14.9	2.7	0.077
10	10	24	2.4	55	0.52	8.5	0.23	0.17	3.0	12.3	2.0	0.055
1,000	15	26	2.6	57	0.55	9.4	0.27	0.18	14.5	14.0	2.4	0.068
20	20	27	2.7	59	0.57	10.2	0.29	0.20	16.0	15.6	2.8	0.080
15	15	27	2.5	57	0.54	9.2	0.26	0.18	15.3	14.6	2.5	0.071
1,100	20	29	2.6	58	0.56	10.0	0.29	0.19	16.8	16.3	2.9	0.083
25	25	31	2.8	59	0.58	10.6	0.31	0.21	18.2	17.9	3.3	0.095
15	15	29	2.4	57	0.54	9.0	0.26	0.18	16.1	15.3	2.6	0.074
1,200	20	30	2.5	58	0.56	9.8	0.28	0.19	17.6	16.9	3.0	0.086
25	25	32	2.7	59	0.58	10.5	0.31	0.21	19.0	18.6	3.4	0.098
15	15	30	2.3	56	0.53	8.9	0.26	0.18	16.8	16.0	2.7	0.077
1,300	20	32	2.4	57	0.55	9.6	0.28	0.19	18.1	17.6	3.1	0.089
25	25	34	2.6	59	0.57	10.3	0.30	0.20	19.7	19.2	3.4	0.102
20	20	33	2.4	57	0.55	9.5	0.28	0.19	18.9	18.2	3.1	0.092
1,400	25	35	2.5	59	0.57	10.1	0.30	0.20	20.5	19.8	3.5	0.105
30	30	37	2.6	59	0.58	10.6	0.32	0.21	21.8	21.5	3.9	0.117
20	20	35	2.3	57	0.55	9.3	0.28	0.19	19.7	18.8	3.2	0.095
1,500	25	37	2.4	58	0.56	9.9	0.30	0.20	21.2	20.5	3.6	0.108
30	30	38	2.6	59	0.58	10.5	0.31	0.21	22.6	22.1	4.0	0.120

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)	DM Intake % of BW	Diet Nutrient Density					Daily Nutrients per Animal				
					TDN (% DM)	NE _m (Mcal/lb) (% DM)	CP (% DM)	Ca (% DM)	P (% DM)	TDN (lbs)	NE _m (Mcal)	CP (lbs)	Ca (lb)	P (lb)
1,000-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
1,200-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
1,400-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
1,000	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
1,100	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

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

		Diet Nutrient Density										Daily Nutrients per Animal			
Current Weight (lbs)	Current BCS ^a (1-9)	ADG ^b (lbs)	DM Intake (lbs/day)	DM Intake % of BW	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															
700	5	1.0 1.5 2.0	16 17 17	2.2 2.4 2.4	57 60 63	0.54 0.59 0.64	8.8 9.9 10.9	0.28 0.34 0.39	0.17 0.20 0.22	8.9 9.9 10.7	8.5 9.8 10.9	1.4 1.6 1.9	0.044 0.055 0.066	0.027 0.032 0.038	
800	6	1.0 1.5 2.0	17 18 19	2.1 2.3 2.4	55 60 63	0.52 0.59 0.64	8.8 9.4 10.2	0.28 0.32 0.36	0.17 0.19 0.21	9.4 10.9 11.9	8.8 10.8 12.0	1.5 1.7 1.9	0.047 0.058 0.067	0.029 0.034 0.039	
900	7	1.0 1.5 2.0	18 19 20	2.0 2.1 2.2	57 62 65	0.54 0.62 0.66	8.8 9.3 9.9	0.28 0.31 0.34	0.18 0.19 0.20	10.2 11.8 12.8	9.7 11.8 13.1	1.6 1.8 2.0	0.051 0.060 0.068	0.032 0.036 0.040	
1200-lb mature weight @ BCS=5															
850	5	1.0 1.5 2.0	18 19 19	2.1 2.2 2.3	57 59 61	0.54 0.57 0.61	8.5 9.4 10.3	0.27 0.32 0.36	0.17 0.19 0.21	10.3 10.9 11.8	9.8 10.7 11.7	1.5 1.8 2.0	0.049 0.060 0.070	0.031 0.036 0.041	
950	6	1.0 1.5 2.0	19 20 21	2.0 2.2 2.2	55 59 62	0.52 0.58 0.62	8.4 9.1 9.8	0.27 0.31 0.34	0.17 0.19 0.20	10.6 12.1 13.0	10.0 11.8 13.0	1.6 1.9 2.1	0.052 0.063 0.072	0.033 0.039 0.043	
1,050	7	1.0 1.5 2.0	20 21 22	1.9 2.0 2.1	57 61 63	0.54 0.60 0.64	8.5 9.1 9.6	0.27 0.30 0.33	0.18 0.19 0.20	11.4 12.9 13.8	10.9 12.8 14.0	1.7 1.9 2.1	0.055 0.065 0.073	0.036 0.040 0.044	
1400-lb mature weight @ BCS=5															
1,020	5	1.0 1.5 2.0	21 21 22	2.0 2.1 2.1	56 58 60	0.52 0.55 0.59	8.3 9.2 9.8	0.26 0.31 0.34	0.17 0.19 0.21	11.4 12.2 12.9	10.8 11.7 12.7	1.7 1.9 2.1	0.054 0.066 0.074	0.035 0.040 0.045	
1,120	6	1.0 1.5 2.0	22 23 23	2.0 2.0 2.1	55 58 60	0.52 0.56 0.59	8.2 8.9 9.4	0.26 0.30 0.33	0.17 0.19 0.20	12.0 13.2 14.1	11.3 12.8 13.9	1.8 2.0 2.2	0.057 0.069 0.077	0.037 0.043 0.047	
1,220	7	1.0 1.5 2.0	23 24 24	1.9 1.9 2.0	57 60 62	0.54 0.59 0.62	8.3 8.8 9.4	0.27 0.30 0.33	0.18 0.19 0.20	12.8 14.0 15.1	12.2 13.8 15.1	1.9 2.1 2.3	0.060 0.070 0.079	0.040 0.044 0.049	

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

Lactating first-calf heifer, first 90 days after calving														
Current Weight (lbs)	Current BCS ^a (1-9)	ADG ^b (lbs)	DM Intake (lbs/day)	DM Intake % of BW	Diet Nutrient Density					Daily Nutrients per Animal				
					TDN (% DM)	NEM (Mcal/lb) (% DM)	CP (% DM)	Ca (%DM)	P (% DM)	TDN (lbs)	NEM (Mcal)	CP (lbs)	Ca (lb)	P (lb)
1,000-lb mature weight @ BCS=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
700	5	0.5	20	2.9	64	0.65	12.0	0.36	0.23	12.9	3.1	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
800	6	0.0	20	2.6	60	0.59	9.7	0.26	0.18	12.2	12.0	2.0	0.054	0.037
		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	.25	16.0	16.7	3.0	0.093	0.058
900	7	0.0	21	2.4	60	0.59	9.8	0.27	0.19	12.7	12.5	2.1	0.057	0.040
		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
1,200-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
950	6	0.0	23	2.4	59	0.57	9.3	0.26	0.18	13.3	12.9	2.1	0.059	0.041
		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
1,050	7	0.0	24	2.2	61	0.60	9.4	0.26	0.18	14.3	14.2	2.2	0.062	0.043
		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
1,400-lb mature weight @ BCS=5														
1,020	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
1,120	6	0.0	25	2.3	58	0.56	9.0	0.25	0.18	14.6	14.2	2.3	0.064	0.045
		0.5	27	2.4	62	0.62	10.4	0.31	0.21	16.6	6.6	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
1,220	7	0.0	27	2.2	62	0.62	9.8	0.28	0.20	16.7	16.7	2.7	0.077	0.053
		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)	Diet Nutrient Density											Daily Nutrients per Animal				
	ADG (lbs)	DM Intake (lbs/day)	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)		
1,200 lbs at 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)	Diet Nutrient Density										Daily Nutrients per Animal				
	ADG (lbs)	DM Intake (lbs/day)	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)	
1,400 lbs at finishing															
300	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	
	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	
400	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	
	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	
500	0.5	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	
	1.0	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	
	1.5	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	
	2.0	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	
	2.5	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	
600	0.5	12.2	80	0.88	0.58	16.8	0.75	0.35	9.8	4.5	3.37	1.84	0.08	0.04	
	1.0	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	
	1.5	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	
	2.0	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	
	2.5	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	
700	0.5	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	
	1.0	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	
	1.5	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	
	2.0	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	
	2.5	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	
800	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)	Diet Nutrient Density											Daily Nutrients per Animal				
	ADG (lbs)	DM Intake (lbs/day)	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)		
1,100 lbs at 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	0.3	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)	Diet Nutrient Density											Daily Nutrients per Animal				
	ADG (lbs)	DM Intake (lbs/day)	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)		
1,200 lbs at 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)	Diet Nutrient Density											Daily Nutrients per Animal				
	ADG (lbs)	DM Intake (lbs/day)	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)		
1,300 lbs at finishing																
715	0.8	18.5	50	0.45	0.20	7.3	0.22	0.13	9.3	5.9	1.1	1.4	0.04	0.02		
	2.1	19.6	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		
780	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		
	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		
845	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		
	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		
910	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		
	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		
975	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		
	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		
1,040	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		
	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)	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)		
1,400 lbs at 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	5.7	7.9	4.6	2.2	0.07	0.04		
1,050	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		
1,120	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)	Diet Nutrient Density											Daily Nutrients per Animal				
	ADG (lbs)	DM Intake (lbs/day)	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)		
1,700-lb mature weight																
900	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		
	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		
1,000	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		
	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		
1,100	0.4	26	50	0.45	0.20	7.0	0.16	0.11	2.8	9.4	1.0	1.8	0.04	0.03		
	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		
1,200	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		
	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		
1,300	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		
1,400	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		
1,500	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		
1,600	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		
1,700	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)	Diet Nutrient Density										Daily Nutrients per Animal				
	ADG (lbs)	DM Intake (lbs/day)	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)	
2,000-lb mature weight															
1,000	0.5	24	50	0.45	0.20	7.0	0.17	0.12	11.9	8.7	1.0	1.7	0.04	0.03	
	1.7	25	60	0.61	0.35	7.5	0.25	0.14	15.1	8.7	3.8	1.9	0.06	0.04	
	2.8	25	70	0.76	0.48	9.1	0.32	0.17	17.2	8.7	6.3	2.2	0.08	0.04	
1,100	3.5	23	80	0.90	0.61	10.5	0.38	0.20	18.6	8.7	8.2	2.4	0.09	0.05	
	0.5	26	50	0.45	0.20	7.0	0.17	0.12	12.8	9.4	1.0	1.8	0.04	0.03	
	1.7	27	60	0.61	0.35	7.1	0.23	0.14	16.2	9.4	4.1	1.9	0.06	0.04	
	2.8	26	70	0.76	0.48	8.4	0.29	0.16	18.5	9.4	6.8	2.2	0.08	0.04	
1,200	3.5	25	80	0.90	0.61	9.8	0.35	0.19	19.9	9.4	8.8	2.4	0.09	0.05	
	0.5	27	50	0.45	0.20	7.0	0.17	0.12	13.7	10.0	1.1	1.9	0.05	0.03	
	1.7	29	60	0.61	0.35	7.0	0.22	0.13	17.3	10.0	4.3	2.0	0.06	0.04	
	2.8	28	70	0.76	0.48	7.9	0.27	0.16	19.7	10.0	7.2	2.2	0.08	0.04	
1,300	3.5	27	80	0.90	0.61	9.0	0.32	0.18	1.3	10.0	9.4	2.4	0.08	0.05	
	0.5	29	50	0.45	0.20	7.0	0.17	0.12	14.5	10.6	1.2	2.0	0.05	0.03	
	1.7	31	60	0.61	0.35	7.0	0.21	0.13	18.4	10.6	4.6	2.2	0.06	0.04	
	2.8	30	70	0.76	0.48	7.4	0.25	0.15	21.0	10.6	7.7	2.2	0.07	0.04	
1,400	3.5	28	80	0.90	0.61	8.4	0.29	0.17	22.6	10.6	10.0	2.4	0.08	0.05	
	0.5	31	50	0.45	0.20	7.0	0.16	0.12	15.4	11.2	1.2	2.2	0.05	0.04	
	1.7	32	60	0.61	0.35	7.0	0.20	0.13	19.4	11.2	4.9	2.3	0.06	0.04	
1,500	0.5	32	50	0.45	0.20	7.0	0.16	0.12	16.2	11.8	1.3	2.3	0.05	0.04	
	1.7	34	60	0.61	0.35	7.0	0.19	0.13	20.5	11.8	5.1	2.4	0.07	0.04	
1,600	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	
	1.7	36	60	0.61	0.35	7.0	0.18	0.12	21.5	12.4	5.4	2.5	0.07	0.04	
1,700	0.5	36	50	0.45	0.20	7.0	0.16	0.12	17.8	13.0	1.4	2.5	0.06	0.04	
	1.7	38	60	0.61	0.35	7.0	0.18	0.12	22.5	13.0	5.6	2.6	0.07	0.05	
1,800	0.5	37	50	0.45	0.20	7.0	0.16	0.12	18.5	13.5	1.5	2.6	0.06	0.04	
	1.7	39	60	0.61	0.35	7.0	0.17	0.12	23.5	13.5	5.9	2.7	0.07	0.05	
1,900	0.5	39	50	0.45	0.20	7.0	0.16	0.12	19.3	14.1	1.5	2.7	0.06	0.05	
	1.7	41	60	0.61	0.35	7.0	0.17	0.12	24.5	14.1	6.1	2.9	0.07	0.05	
2,000	0.0	37	46	0.39	0.00	7.0	0.17	0.13	17.1	14.6	0.0	2.6	0.06	0.05	
	0.5	40	50	0.45	0.20	7.0	0.16	0.12	20.1	14.6	1.6	2.8	0.07	0.05	

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

Body Weight (lbs)	Diet Nutrient Density											Daily Nutrients per Animal				
	ADG (lbs)	DM Intake (lbs/day)	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)		
2,300-lb mature weight																
1,200	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		
	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		
1,300	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		
1,400	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		
1,500	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		
1,600	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		
1,700	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		
1,800	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		
1,900	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		
2,000	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		
2,100	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		
2,200	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		
2,300	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	Cows				Maximum Tolerable Level
		Growing and Finishing ^a	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	1,000.00	
Manganese	ppm	20.00	40.00	40.00	1,000.00	
Selenium	ppm	0.10	0.10	0.10	2.00	
Zinc	ppm	0.00	30.00	30.00	500.00	
Vitamin A	IU/lb	1,000.00	300.00	800.00	--	
Vitamin D	IU/lb	125.00	125.00	125.00	--	

^a Also for breeding bulls.

Source: NRC.

Table 8. Estimated voluntary daily water intake of growing and finishing cattle (gallons)^a.

Weight (lbs)	Temperature (F) ^b					
	40	50	60	70	80	90
<i>Growing heifers, steers, and bulls</i>						
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
<i>Finishing cattle</i>						
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
1,000	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.

Table 9. Estimated Voluntary daily water intake of beef cows.

		<i>Average Daily Temperature</i>		
<i>C</i>		<i>4</i>	<i>18</i>	<i>32</i>
<i>F</i>		<i>40</i>	<i>65</i>	<i>90</i>
<i>Cow body weight (lb)</i>	<i>Milk production (lb/day)</i>	<i>* Gallons of water per day</i>		
1,100	0	8.2	10.8	13.4
1,100	10	10.5	13.1	15.7
1,100	25	12.8	15.4	17.9
1,300	0	9.2	11.8	14.3
1,300	15	12.2	14.8	17.4
1,300	30	14.5	17.1	19.7
1,500	0	10.2	12.7	15.3
1,500	20	14.0	16.5	19.1
1,500	35	16.3	18.8	21.4

* 1 gallon is equivalent to 8.35 pounds.

