Basic Requirements

It is imperative that cattle producers have an adequate understanding of the basic nutrient requirements of the cow herd to make informed and effective nutrition-related decisions.

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Meeting the basic nutrient requirements of beef cows is a key component of meeting cow herd production and profitability goals for the beef cattle enterprise.

Table 1: Intake guidelines, as % of body weight, for beef cows, by forage quality

	Gestating cow	Lactating cow
Low-quality forage (<52% TDN)		
Unsupplemented	1.8	2.0
Protein supplemented	1.8	2.2
Energy supplemented[1]	1.5	2.0
Medium-quality forage (52%-59% TDN)		
Unsupplemented	2.0	2.3
Protein supplemented	2.2	2.5
Energy supplemented[1]	2.0	2.3
High-quality forage (>59% TDN)		
Unsupplemented	2.5	2.7
Protein supplemented	2.5	2.7
Energy supplemented[2]	2.5	2.7

[1]Above 4 pounds (lb.) of supplement, each 1 lb. of supplement decreases forage consumption by 0.6 lb.

[2]Pound-for-pound substitution of supplement for forage.

Adequate nutrition is vital for adequate cow reproduction, cow and calf health, and growth of all classes of cattle. Nutrient requirements of cattle change throughout the year based upon stage of the production cycle, age, sex, breed, level of activity, pest load and environment.

All of these factors have an additive effect on the nutrient requirements of cattle. In all cases, specific adjustments to the standard nutrient requirements may be warranted. Therefore, it is imperative that cattle producers have an adequate understanding of the basic nutrient requirements of the cow herd to make informed and effective nutrition-related decisions.

In most production situations, the basis for cow herd nutrient supply is grazed or harvested forage. With the use of forage comes the need for seasonal supplementation strategies to compensate for forage-quality deficiencies. Without knowledge of the cow's basic nutrient requirements, effective and

cost-effective supplementation practices will be difficult to implement.

This article will discuss the basic nutrients that are required for production and provide tables indicating diet concentration and daily intake requirements of key nutrients for beef cattle. The information contained here is based upon the recommendations published in the *Nutrient Requirements of Beef Cattle* (2000).

Dry-matter intake

Beef cattle have no requirement for feed intake; however, consumption of adequate levels of feedstuffs is imperative to deliver the required nutrients for adequate production. Dry-matter intake (DMI) is affected by a number of factors, including cow body weight, stage of production, forage quality, supplementation level and type, and environmental factors.

Cattle of larger frame size and body weight have greater potential to consume forage and feed compared to smaller-frame or lighter-body-weight cattle. Likewise, lactating cows have greater DMI potential compared to gestating cows. Additionally, thin cows are more likely to consume greater amounts of feedstuffs compared to well-conditioned cows.

Forage intake is generally limited by forage quality. The greater the forage quality (energy and protein concentrations, digestibility, etc.) of the base forage, the greater the potential for increased DMI by cattle. The estimates of DMI listed in the tables were determined by prediction equations. These prediction equations assume diets that are adequate in all required nutrients. Likewise, examination of the tables will show that differences in DMI occur across mature body weight, cow milking ability and stage of production cycle. Table 1 provides some general guidelines for prediction of forage DMI based upon forage quality and cow production stage.

Water

Water is an important, yet sometimes overlooked, nutrient required by cattle. Water is a vital component in many body functions, including temperature regulation, growth, reproduction, lactation and many metabolic functions. Water comes from two sources: feedstuffs and *ad libitum* consumption.

The water requirement is influenced by several factors, including pregnancy, lactation, activity, type of diet, level of intake and environmental temperature. Restriction of water intake below requirement will reduce feed intake, which will reduce cattle production.

Cattle lose water from the body through a number of routes. Sources of water loss include urine, feces, sweat, and water vapor from the skin and lungs. Urine production depends upon activity level, air temperature, water consumption and other factors. The amount of water loss in the feces depends upon the diet. Clean water is especially important for young growing cattle, while dirty water can decrease cattle performance and be a potential source of disease. Basic total water intake requirements are indicated in Table 2.

Table 2: Approximate total daily water requirement, in gallons, of beef cows and bulls[1]

	Temperature, ° F[2]					
	40	50	60	70	80	90
Pregnant cows[3]						
900 lb.	6.7	7.2	8.3	9.7	11.4	13.7
1,100 lb.	6.0	6.5	7.4	8.7	10.4	12.5
Lactating cows						
All weights	11.4	12.6	14.5	16.9	17.9	16.2
Mature bulls						
1,400 lb.	8.0	8.6	9.9	11.7	13.4	19.0
1,600 lb.	8.7	9.4	10.8	12.6	14.5	20.6

[1]Adapted from the *Nutrient Requirements of Beef Cattle,* published by the National Research Council, 2000.

[2]Water intake of a given class of cattle in a specific management system is a function of DMI and temperature. Water intake is constant up to 40° F.

[3]DMI has a major influence on water intake. Heavier cows are assumed to be in better condition and thus require less DMI and, in turn, less water intake.

Energy

Energy requirements are expressed in the following tables in terms of total digestible nutrients (TDN) and net energy for maintenance (NE_m). Total digestible nutrients are the sum of digestible starch, fiber, protein and fat in the feedstuffs. Energy requirements, expressed as TDN, are shown in the tables as a percent of the diet dry matter or as pounds per day. The net-energy (NE) system assigns energy values of feeds according to how the energy within a feedstuff can be assigned to either maintenance or growth/lactation/pregnancy. Likewise, the amount of energy needed for maintenance or growth can be determined independent of the dietary composition. The NE_m requirement is expressed as megacalories (Mcal) per pound or megacalories per day.

Cow energy requirements change throughout the year. The requirement for energy by the mature cow is a dynamic situation because the production cycle is not static.

At no point in a yearly production cycle does a cow experience only maintenance energy requirements. We may say that "a cow is just maintaining herself," but if she is a productive member of the herd, more than maintenance is occurring on a daily basis.

Maintenance is defined as the amount of feed energy intake that will result in no net loss or gain of energy from the tissues of the cow's body. In reality, a cow must always be adding or subtracting energy from her body tissues. The additive functions to maintenance include growth, gestation and lactation. All ongoing energetic functions result in the total energy requirement of the cow.

- **Maintenance.** Interestingly, not all maintenance is considered equal. There exist two distinct phases of NE_m requirements: during the lactation period and during the dry period. About a 20% difference exists between these two periods. This increase in maintenance energy requirement associated with lactation is due to the increased metabolic demand upon body tissues, not the resulting product of lactation (milk).

  Additionally, the initial energy requirement does not account for any energy expenditure for activity associated with grazing. The difference in maintenance energy requirements for grazing cattle could be from 10% to 50% depending upon the grazing conditions and forage availability.

- **Lactation.** The energy requirement for lactation is a function of milk yield, milk fat percent and milk protein percent.

CONTINUED ON PAGE 296

Basic Requirements CONTINUED FROM PAGE 295

These variables change during the lactation cycle. Thus, the energy requirement of lactation changes accordingly.

Identified differences between and within breeds that affect milk yield and milk composition also affect the lactation energy requirement. Unlike other energy requirements, lactation has a rapid onset of demand for energy that is initiated by parturition. The development of mammary tissue occurs prepartum, but the majority of the lactation energy requirement is associated with milk production.

► **Gestation.** The energy requirement associated with pregnancy is an underlying energetic demand for 10 out of 12 months during the yearly production cycle. Whereas the energy required for gestation is initially very small, just 0.1% of the energy requirement during the third month postpartum.

In contrast, the gestation energy requirement one month prior to parturition is approximately 56% of the total energy requirement. The postweaning period is often referred to as a "maintenance period" for the grazing beef cow. Indeed, gestational requirements at weaning do not equate to the greater energetic demand of lactation; however, this is an important energetic supply and demand period. This period is utilized for growth of the products of conception.

► **Growth.** Growth in the case of the mature cow herd can be construed as the recovery of body-tissue energy (i.e., body weight and body condition) not associated with the products of conception. During a small time period after the cessation of lactation and prior to the accelerated fetal growth, additional energy supplied to the cow can be used for growth of body tissues. This growth is used to regain lost body weight and body condition score (BCS) due to the mobilization of body tissues during lactation. These accreted body tissues will most likely be reused at some point during the production cycle to support maintenance or lactation.

Protein

Protein requirements are expressed in the

Table 3: Nutrient requirements of a 1,000-lb. mature cow, by peak milk-production level

	Months since calving											
	1	2	3	4	5	6	7	8	9	10	11	12
10 lb. peak milk production												
DMI, lb./day	21.6	22.1	23.0	22.5	22.1	21.0	21.1	21.0	20.9	20.8	21.0	21.4
TDN, %	55.8	56.6	54.3	53.4	52.5	51.8	44.9	45.7	47.0	49.1	52.0	55.7
NE_m, Mcal/lb.	0.55	0.56	0.52	0.51	0.49	0.48	0.37	0.38	0.40	0.44	0.49	0.54
CP, %	8.70	9.10	8.41	7.97	7.51	7.14	5.98	6.16	6.47	6.95	7.66	8.67
Ca, %	0.24	0.25	0.23	0.22	0.20	0.19	0.15	0.15	0.15	0.24	0.24	0.24
P, %	0.17	0.17	0.16	0.15	0.14	0.14	0.11	0.11	0.11	0.15	0.15	0.15
TDN, lb./day	12.05	12.51	12.49	12.02	11.60	10.88	9.47	9.60	9.82	10.21	10.92	11.92
NE_m, Mcal/day	11.88	12.38	11.96	11.48	10.83	10.08	7.81	7.98	8.36	9.15	10.29	11.56
CP, lb./day	1.88	2.01	1.93	1.79	1.66	1.50	1.26	1.29	1.35	1.45	1.61	1.86
Ca, lb./day	0.05	0.06	0.05	0.05	0.04	0.04	0.03	0.03	0.03	0.05	0.05	0.05
P, lb./day	0.04	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.03	0.03
20 lb. peak milk production												
DMI, lb./day	24.0	25.0	25.4	24.4	23.5	22.7	21.1	21.0	20.9	20.8	21.0	21.4
TDN, %	59.6	60.9	58.6	57.0	55.4	54.0	44.9	45.7	47.0	49.1	52.0	55.7
NE_m, Mcal/lb.	0.60	0.62	0.59	0.56	0.54	0.52	0.37	0.38	0.40	0.44	0.49	0.54
CP, %	10.54	11.18	10.38	9.65	8.86	8.17	5.98	6.16	6.47	6.95	7.66	8.67
Ca, %	0.30	0.32	0.30	0.27	0.24	0.22	0.15	0.15	0.15	0.24	0.24	0.24
P, %	0.20	0.21	0.19	0.18	0.17	0.15	0.11	0.11	0.11	0.15	0.15	0.15
TDN, lb./day	14.30	15.23	14.88	13.91	13.02	12.26	9.47	9.60	9.82	10.21	10.92	11.92
NE_m, Mcal/day	14.40	15.50	14.99	13.66	12.69	11.80	7.81	7.98	8.36	9.15	10.29	11.56
CP, lb./day	2.53	2.80	2.64	2.35	2.08	1.85	1.26	1.29	1.35	1.45	1.61	1.86
Ca, lb./day	0.07	0.08	0.08	0.07	0.06	0.05	0.03	0.03	0.03	0.05	0.05	0.05
P, lb./day	0.05	0.05	0.05	0.04	0.04	0.03	0.02	0.02	0.02	0.03	0.03	0.03
30 lb. peak milk production												
DMI, lb./day	26.4	27.8	27.8	23.4	24.9	23.7	21.1	21.0	20.9	20.8	21.0	21.4
TDN, %	62.8	64.5	62.1	60.1	57.9	55.9	44.9	45.7	47.0	49.1	52.0	55.7
NE_m, Mcal/lb.	0.65	0.68	0.64	0.61	0.58	0.55	0.37	0.38	0.40	0.44	0.49	0.54
CP, %	12.06	12.86	12.00	11.07	10.04	9.09	5.98	6.16	6.47	6.95	7.66	8.67
Ca, %	0.35	0.38	0.35	0.32	0.28	0.25	0.15	0.15	0.15	0.24	0.24	0.24
P, %	0.22	0.24	0.22	0.21	0.19	0.17	0.11	0.11	0.11	0.15	0.15	0.15
TDN, lb./day	16.58	17.93	17.26	15.87	14.42	13.25	9.47	9.60	9.82	10.21	10.92	11.92
NE_m, Mcal/day	17.16	18.90	17.79	16.10	14.44	13.04	7.81	7.98	8.36	9.15	10.29	11.56
CP, lb./day	3.18	3.58	3.34	2.92	2.50	2.15	1.26	1.29	1.35	1.45	1.61	1.86
Ca, lb./day	0.09	0.11	0.10	0.08	0.07	0.06	0.03	0.03	0.03	0.05	0.05	0.05
P, lb./day	0.06	0.07	0.06	0.06	0.05	0.04	0.02	0.02	0.02	0.03	0.03	0.03

Adapted from the *Nutrient Requirements of Beef Cattle*, published by the National Research Council, 2000.

tables in terms of crude protein (CP). The protein requirement of cattle is shown in the tables as a percent of the diet dry matter or as pounds per day. Similar to energy, a cow's protein requirements change throughout the year. The requirement for protein is dependent upon the age of the cow, stage of production and level of production. Protein requirements, like energy, are additive during any point in the cow's production cycle.

The CP system, as the name implies, is a crude measurement of the protein in any feedstuffs. The amount of CP in a feedstuff is a calculation determined by the following equation: CP = nitrogen concentration × 6.25. The CP system is the basic description of protein for cattle. However, protein requirements have been further characterized to indicate the amount of protein that is actually available for the cow to metabolize.

Cattle protein requirements are met by two basic sources: the feedstuffs they consume and the microorganisms that populate the rumen. The protein component of feedstuffs can be divided into two fractions identified as degradable intake protein (DIP) and undegradable intake protein (UIP).

The DIP fraction is composed of the protein fraction of the diet that is digested in the rumen, used by rumen microorganisms, and ultimately results in bacterial (microbial) protein; or that passes through the rumen wall as ammonia and is ultimately metabolized in the liver. In the liver, excess nitrogen (N) is metabolized to urea, which can be recycled back to the gastrointestinal tract or excreted through the kidney into urine.

The UIP fraction is composed of the protein fraction of the diet that is not digested in the rumen and that thereby "escapes or bypasses" the rumen. The UIP protein may then be digested and absorbed in the small intestine. Together, the bacterial protein and UIP fraction comprise the metabolizable protein available for the cow to meet her protein requirement.

► **Maintenance.** The general rule of thumb is that forages with a CP concentration of 7% or greater are adequate to meet a

CONTINUED ON PAGE 298

Table 4: Nutrient requirements of a 1,200-lb. mature cow, by peak milk-production level

	Months since calving											
	1	2	3	4	5	6	7	8	9	10	11	12
10 lb. peak milk production												
DMI, lb./day	24.4	24.9	26.0	25.6	25.1	24.8	24.2	24.1	24.0	23.9	21.4	24.6
TDN, %	55.3	56.0	53.7	52.9	52.1	51.5	44.9	45.8	47.1	49.3	52.3	56.2
NE_m, Mcal/lb.	0.54	0.55	0.51	0.50	0.49	0.48	0.37	0.38	0.41	0.44	0.49	0.55
CP, %	8.43	8.79	8.13	7.73	7.33	7.00	5.99	6.18	6.50	7.00	7.73	8.78
Ca, %	0.24	0.25	0.23	0.21	0.20	0.19	0.15	0.15	0.15	0.26	0.25	0.25
P, %	0.17	0.17	0.16	0.15	0.14	0.14	0.12	0.12	0.12	0.16	0.16	0.16
TDN, lb./day	13.49	13.94	13.96	13.54	13.08	12.77	10.87	11.04	11.30	11.78	11.19	13.83
NE_m, Mcal/day	13.18	13.70	13.29	12.80	12.30	11.90	8.95	9.16	9.84	10.52	10.49	13.53
CP, lb./day	2.06	2.19	2.11	1.98	1.84	1.74	1.45	1.49	1.56	1.67	1.65	2.16
Ca, lb./day	0.06	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.06	0.05	0.06
P, lb./day	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.04
20 lb. peak milk production												
DMI, lb./day	26.8	27.8	28.4	27.4	26.5	25.7	24.2	24.1	24.0	23.9	21.4	24.6
TDN, %	58.7	59.9	57.6	56.2	54.7	53.4	44.9	45.8	47.1	49.3	52.3	56.2
NE_m, Mcal/lb.	0.59	0.61	0.57	0.55	0.53	0.51	0.37	0.38	0.41	0.44	0.49	0.55
CP, %	10.10	10.69	9.92	9.25	8.54	7.92	5.99	6.18	6.50	7.00	7.73	8.78
Ca, %	0.29	0.31	0.29	0.26	0.24	0.22	0.15	0.15	0.15	0.26	0.25	0.25
P, %	0.19	0.21	0.19	0.18	0.17	0.15	0.12	0.12	0.12	0.16	0.16	0.16
TDN, lb./day	15.73	16.65	16.36	15.40	14.50	13.72	10.87	11.04	11.30	11.78	11.19	13.83
NE_m, Mcal/day	15.81	16.96	16.19	15.07	14.05	13.11	8.95	9.16	9.84	10.52	10.49	13.53
CP, lb./day	2.71	2.97	2.82	2.53	2.26	2.04	1.45	1.49	1.56	1.67	1.65	2.16
Ca, lb./day	0.08	0.09	0.08	0.07	0.06	0.06	0.04	0.04	0.04	0.05	0.06	0.06
P, lb./day	0.05	0.06	0.05	0.05	0.05	0.04	0.03	0.03	0.03	0.04	0.03	0.04
30 lb. peak milk production												
DMI, lb./day	29.2	30.6	30.8	28.4	27.9	23.7	24.2	21.1	24.0	23.9	21.4	24.6
TDN, %	61.6	63.2	60.8	59.0	57.0	55.2	44.9	45.8	47.1	49.3	52.3	56.2
NE_m, Mcal/lb.	0.64	0.66	0.62	0.59	0.56	0.54	0.37	0.38	0.41	0.44	0.49	0.55
CP, %	11.51	12.25	11.41	10.55	9.61	8.45	5.99	6.18	6.50	7.00	7.73	8.78
Ca, %	0.34	0.36	0.34	0.31	0.27	0.25	0.15	0.15	0.15	0.26	0.25	0.25
P, %	0.22	0.23	0.22	0.20	0.18	0.17	0.12	0.12	0.12	0.16	0.16	0.16
TDN, lb./day	17.99	19.34	18.73	17.35	15.90	14.74	10.87	11.04	11.30	11.78	11.19	13.83
NE_m, Mcal/day	18.69	20.20	19.10	17.35	15.62	14.42	8.95	9.16	9.84	10.52	10.49	13.53
CP, lb./day	3.36	3.76	3.51	3.10	2.68	2.34	1.45	1.49	1.56	1.67	1.65	2.16
Ca, lb./day	0.10	0.11	0.10	0.09	0.08	0.07	0.04	0.04	0.04	0.06	0.05	0.06
P, lb./day	0.06	0.07	0.07	0.06	0.05	0.05	0.03	0.03	0.03	0.04	0.03	0.04

Adapted from the *Nutrient Requirements of Beef Cattle,* published by the National Research Council, 2000.

Basic Requirements CONTINUED FROM PAGE 297

mature cow's CP requirements. Research has shown that the bacterial protein fraction of the diet can provide anywhere from 50% to all of the cow's metabolizable protein requirement depending upon the UIP content of the diet. This would imply that forage-based diets of sufficient CP concentration can maintain a mature cow during certain phases of the cow's productive cycle.

► **Lactation.** Lactation is the most stressful time in the cow production cycle. Milk contains a large concentration of protein. The source of the protein in milk comes either from dietary sources or mobilization of body lean tissue. Mobilization of lean tissue decreases the overall BCS of the cow. Research indicates that maintenance of BCS from calving to rebreeding is imperative to ensure acceptable conception rates. Therefore, adequate protein from the diet is an important nutritional consideration.

► **Gestation.** The effect of gestation does not greatly affect the cow's protein requirement during the first seven months of gestation. The majority of the protein requirement is associated with placental development and growth. However, during the last two months of gestation, two-thirds of the fetal growth occurs. This fetal growth results in a large demand on maternal protein supply. Thus, protein requirements leading up to parturition are largely associated with fetal growth and other products of conception. During this period, the cow will sacrifice body condition to support fetal growth. Additionally, adequate protein status leading up to parturition is essential for the production of adequate high-quality colostrum to support newborn calf health.

► **Growth.** Like energy, protein requirements for mature cattle are associated with the recovery of lean body tissue that was mobilized during the production cycle. Lean-tissue mobilization supplies a good deal of protein when it is needed. However,

CONTINUED ON PAGE 300

Table 5: Nutrient requirements of a 1,400-lb. mature cow, by peak milk-production level

	Months since calving											
	1	2	3	4	5	6	7	8	9	10	11	12
10 lb. peak milk production												
DMI, lb./day	27.1	27.6	28.9	28.5	28.0	27.7	27.2	27.0	26.9	26.8	27.0	27.6
TDN, %	54.9	55.5	53.3	52.5	51.8	51.2	45.0	45.8	47.3	49.5	52.6	56.6
NE_m, Mcal/lb.	0.53	0.54	0.51	0.49	0.48	0.47	0.37	0.39	0.41	0.44	0.49	0.56
CP, %	8.23	8.56	7.91	7.55	7.19	6.90	6.00	6.20	6.53	7.04	7.80	8.88
Ca, %	0.23	0.25	0.23	0.21	0.20	0.19	0.16	0.16	0.16	0.27	0.26	0.26
P, %	0.17	0.17	0.16	0.15	0.15	0.14	0.12	0.12	0.12	0.17	0.17	0.16
TDN, lb./day	14.88	15.32	15.40	14.96	14.50	14.18	12.24	12.37	12.72	13.27	14.20	15.62
NE_m, Mcal/day	14.36	14.90	14.74	13.97	13.44	13.02	10.06	10.53	11.03	11.79	13.23	15.46
CP, lb./day	2.23	2.36	2.29	2.15	2.01	1.91	1.63	1.67	1.76	1.89	2.11	2.45
Ca, lb./day	0.06	0.07	0.07	0.06	0.06	0.05	0.04	0.04	0.04	0.07	0.07	0.07
P, lb./day	0.05	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.05	0.05	0.04
20 lb. peak milk production												
DMI, lb./day	29.5	30.5	31.3	30.3	29.4	28.6	27.2	27.0	26.9	26.8	27.0	27.6
TDN, %	58.0	59.1	56.8	55.5	54.1	53.0	45.0	45.8	47.3	49.5	52.6	56.6
NE_m, Mcal/lb.	0.58	0.60	0.56	0.54	0.52	0.50	0.37	0.39	0.41	0.44	0.49	0.56
CP, %	9.76	10.31	9.56	8.94	8.29	7.73	6.00	6.20	6.53	7.04	7.80	8.88
Ca, %	0.28	0.30	0.28	0.26	0.24	0.22	0.16	0.16	0.16	0.27	0.26	0.26
P, %	0.19	0.20	0.19	0.18	0.17	0.16	0.12	0.12	0.12	0.17	0.17	0.16
TDN, lb./day	17.11	18.03	17.78	16.82	15.91	15.16	12.24	12.37	12.72	13.27	14.20	15.62
NE_m, Mcal/day	17.11	18.30	17.53	16.36	15.29	14.30	10.06	10.53	11.03	11.79	13.23	15.46
CP, lb./day	2.88	3.14	2.99	2.71	2.44	2.21	1.63	1.67	1.76	1.89	2.11	2.45
Ca, lb./day	0.08	0.09	0.09	0.08	0.07	0.06	0.04	0.04	0.04	0.07	0.07	0.07
P, lb./day	0.06	0.06	0.06	0.05	0.05	0.05	0.03	0.03	0.03	0.05	0.05	0.04
30 lb. peak milk production												
DMI, lb./day	31.9	33.3	33.7	32.3	30.8	29.6	27.2	27.0	26.9	26.8	27.0	27.6
TDN, %	60.7	62.2	59.8	58.1	26.2	24.7	45.0	45.8	47.3	49.5	52.6	56.6
NE_m, Mcal/lb.	0.62	0.64	0.61	0.58	0.55	0.53	0.37	0.39	0.41	0.44	0.49	0.56
CP, %	11.07	11.77	10.95	10.15	9.27	8.49	6.00	6.20	6.53	7.04	7.80	8.88
Ca, %	0.33	0.35	0.32	0.30	0.27	0.24	0.16	0.16	0.16	0.27	0.26	0.26
P, %	0.22	0.23	0.21	0.20	0.18	0.17	0.12	0.12	0.12	0.17	0.17	0.16
TDN, lb./day	19.36	20.71	20.15	18.77	17.31	16.19	12.24	12.37	12.72	13.27	14.20	15.62
NE_m, Mcal/day	19.78	21.31	20.56	18.73	16.94	15.69	10.06	10.53	11.03	11.79	13.23	15.46
CP, lb./day	3.53	3.92	3.69	3.28	2.86	2.51	1.63	1.67	1.76	1.89	2.11	2.45
Ca, lb./day	0.11	0.12	0.11	0.10	0.08	0.07	0.04	0.04	0.04	0.07	0.07	0.07
P, lb./day	0.07	0.08	0.07	0.06	0.06	0.05	0.03	0.03	0.03	0.05	0.05	0.04

Adapted from the *Nutrient Requirements of Beef Cattle,* published by the National Research Council, 2000.

because of differences in the efficiency of protein usage, a greater amount of dietary crude protein beyond maintenance requirements is needed to replace the mobilized tissue.

Calcium and phosphorus

Calcium (Ca) is the most abundant mineral in the body and is an important component for bones, teeth, membrane permeability, muscle contraction and many other metabolic functions. The calcium requirements listed in the tables are converted to dietary calcium requirements, assuming a true absorption of 50%. Absorption of calcium is largely determined by the balance of requirement and intake. Skeletal reserves serve as a large repository of calcium that can be used to maintain blood concentrations.

Phosphorus (P) is generally discussed with calcium because the two minerals function together in bone metabolism. Phosphorus is predominantly associated with bones and teeth, but also functions in cell growth, energy usage and membrane formation. Historically, the calcium-to-phosphorus ratio recommendation has been 2-to-1; however, research has indicated that ratios between 1-to-1 and 7-to-1 result in similar performance assuming that the dietary phosphorus requirement was met.

Conclusions

The key concept to remember in feeding a beef cow herd is the cattle need to be fed to meet nutrient requirements. Cows do not have requirements for specific feeds; they have requirements for energy and specific nutrients. Energy and other nutrients will first be used to meet the cow's maintenance requirements, and then nutrients and energy will be allocated to productive uses (growth, reproduction and lactation). The data presented in these tables are to be used as guidelines and a starting point for nutrition decision-making.

AJ

Editor's Note: *Matt Hersom is associate professor in the animal science department at the University of Florida Institute of Food and Agricultural Science (UF/IFAS), Gainesville. This document was originally published in October 2007 as* AN190, *one of a series published by the animal science department of UF/IFAS. It was reviewed in 2010.*

Table 6: Nutrient requirements of a 1,600-lb. mature cow, by peak milk-production level

	Months since calving											
	1	2	3	4	5	6	7	8	9	10	11	12
10 lb. peak milk production												
DMI, lb./day	29.8	30.3	31.8	31.4	31.1	30.6	30.2	30.0	26.9	29.7	29.9	30.6
TDN, %	54.5	55.0	52.9	52.1	51.4	51.0	45.0	45.8	47.5	49.7	52.9	56.9
NE_m, Mcal/lb.	0.52	0.53	0.50	0.48	0.48	0.47	0.38	0.39	0.42	0.45	0.49	0.56
CP, %	8.03	8.33	7.69	7.3	7.05	6.8	6.01	6.22	6.56	7.10	7.87	8.98
Ca, %	0.23	0.25	0.23	0.21	0.20	0.19	0.16	0.16	0.16	0.27	0.26	0.26
P, %	0.17	0.17	0.16	0.15	0.15	0.14	0.12	0.12	0.12	0.17	0.17	0.17
TDN, lb./day	16.24	16.67	16.82	16.36	15.99	15.61	13.59	13.74	12.78	14.76	15.82	17.41
NE_m, Mcal/day	15.50	16.06	15.90	15.07	14.93	14.38	11.48	11.70	11.30	13.37	14.65	17.14
CP, lb./day	2.39	2.52	2.45	2.29	2.19	2.08	1.82	1.87	1.76	2.11	2.35	2.75
Ca, lb./day	0.07	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.04	0.08	0.08	0.08
P, lb./day	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.03	0.05	0.05	0.05
20 lb. peak milk production												
DMI, lb./day	32.1	33.1	34.0	33.0	32.2	31.4	30.1	29.9	29.8	29.7	29.9	30.5
TDN, %	57.5	59.0	56.7	55.3	54.0	53.0	45.0	45.8	47.5	49.7	52.9	60.0
NE_m, Mcal/lb.	0.57	0.59	0.56	0.53	0.51	0.50	0.37	0.39	0.41	0.44	0.49	0.56
CP, %	9.5	10.10	9.30	8.70	8.05	7.50	6.05	6.25	6.55	7.10	7.90	8.95
Ca, %	0.27	0.29	0.27	0.25	0.23	0.21	0.16	0.16	0.16	0.27	0.26	0.26
P, %	0.17	0.18	0.17	0.16	0.15	0.14	0.10	0.10	0.10	0.15	0.15	0.16
TDN, lb./day	18.46	19.53	19.28	18.25	17.39	16.64	13.55	13.69	14.16	14.76	15.82	18.30
NE_m, Mcal/day	18.30	19.53	19.04	17.49	16.42	15.70	11.14	11.66	12.22	13.07	14.65	17.08
CP, lb./day	3.05	3.34	3.16	2.87	2.59	2.36	1.82	1.87	1.95	2.11	2.36	2.73
Ca, lb./day	0.09	0.10	0.09	0.08	0.07	0.07	0.05	0.05	0.05	0.08	0.08	0.08
P, lb./day	0.05	0.06	0.06	0.05	0.05	0.04	0.03	0.03	0.03	0.04	0.04	0.05
30 lb. peak milk production												
DMI, lb./day	34.6	36.0	36.4	35.0	33.5	32.3	30.0	29.5	29.4	29.3	29.5	30.0
TDN, %	59.9	61.3	59.0	57.3	55.4	50.0	45.0	45.8	47.3	50.0	53.1	57.0
NE_m, Mcal/lb.	0.62	0.65	0.62	0.59	0.56	0.54	0.37	0.39	0.41	0.44	0.49	0.57
CP, %	10.74	11.50	10.70	9.90	9.15	8.40	6.00	6.22	6.60	8.05	8.80	9.95
Ca, %	0.32	0.34	0.31	0.29	0.26	0.23	0.15	0.15	0.15	0.26	0.26	0.26
P, %	0.22	0.23	0.21	0.20	0.18	0.17	0.12	0.12	0.12	0.17	0.17	0.17
TDN, lb./day	20.73	22.07	21.48	20.06	18.56	16.15	13.50	13.51	13.91	14.65	15.66	17.10
NE_m, Mcal/day	21.45	23.40	22.57	20.65	18.76	17.44	11.10	11.51	12.05	12.89	14.46	17.10
CP, lb./day	3.72	4.14	3.89	3.47	3.07	2.71	1.80	1.83	1.94	2.36	2.60	2.99
Ca, lb./day	0.11	0.12	0.11	0.10	0.09	0.07	0.05	0.04	0.04	0.08	0.08	0.08
P, lb./day	0.08	0.08	0.08	0.07	0.06	0.05	0.04	0.04	0.04	0.05	0.05	0.05

Adapted from the *Nutrient Requirements of Beef Cattle,* published by the National Research Council, 2000.