

Nutrition and Feeding of the Cow-Calf Herd: Production Cycle Nutrition and Nutrient Requirements of Cows, Pregnant Heifers and Bulls

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Developing diets and feeding strategies for the cow-herd is facilitated by a basic understanding of the production cycle of the cow and her changing nutrient requirements. By knowing and anticipating the changing nutritional needs of the cow, producers can plan their feeding programs and lower feed costs. Cows use the nutrients provided to them for bodily processes in the following order: 1) maintenance – keep alive and moving, 2) lactation – providing milk for the calf, 3) growth – including weight gain, and 4) reproduction.

Beef cow production cycle

For nutritional and most management purposes, the annual production cycle for the beef cow can be divided into 4 phases: Pre-calving, Postpartum, Lactating and Pregnant, and Gestation. Each one of these phases is physiologically unique and each has its own set of nutritional requirements (Figure 1). Calving is the event on which all of these periods are based, so that's where we will start.

Postpartum (after calving) is the 80 to 90 day period that begins at calving. It is the period of greatest nutritional demand (Table 1 & 2). Cows must lactate, repair their reproductive tracts, resume heat cycles, breed, increase activity and, if young, grow. All these processes put considerable strain on the cow. However, her voluntary feed intake, how much feed she will eat, is highest during the postpartum period. If she is not fed to meet her nutritional demands, she will fail or be delayed in rebreeding and lose weight.

Lactating and Pregnant is a period of 120 to 130 days. Nutritional requirements are still high. However,

energy requirements decrease about 13% and protein needs about 8% compared to the postpartum period. During the lactating and pregnant period, cows reach peak lactation and then decrease milk production. Cows are pregnant, but the limited fetal growth does not add much to requirements. However, activity is still high, and two and three year-olds must continue to grow. Cows usually lose some weight during this period.

Gestation is the 100-110 day period immediately after the calves are weaned. Nutritional requirements are at their lowest because lactation has ceased. Energy needs are 23% less than the previous period and protein requirements drop by 36%. This is the best time to put

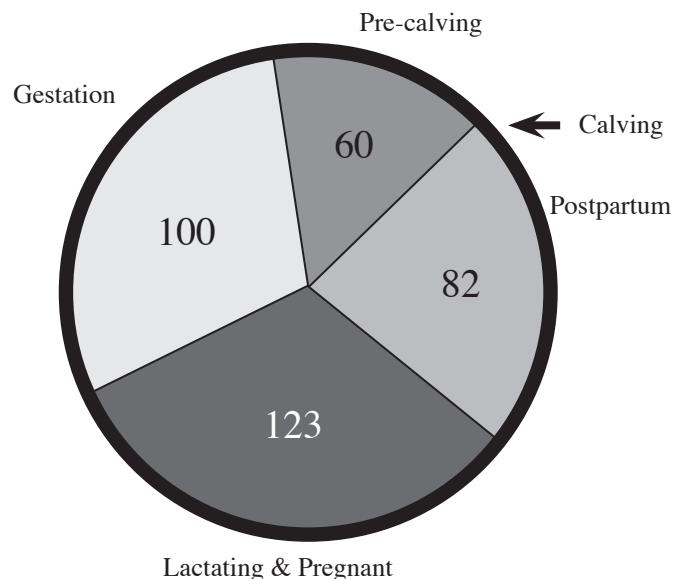


Figure 1. Nutritional & Management phases of the annual cow production cycle.

weight back on thin cows and increase body condition to BCS 5 or 6. Cows are pregnant, but growth of the developing calf is still slow and activity decreases; however, heifers still need to gain 1 to 1.5 lbs per day. The cow's voluntary feed intake is lowest during this period.

Pre-calving is the period 50 to 60 days immediately before calving. This is the most critical period of the year. Cows must reach or preferably maintain body condition score 5 or 6 during this period. Cows must calve in body condition score 5 or greater to have healthy calves and breed back quickly (Figure 2). Energy and protein needs increase by 20% or more compared to gestation (Table 1 and 2). Fetal growth is rapid. The calf may gain 60 lbs during pre-calving, and the placenta is also growing. Cows need to gain 1 to 1.25 lbs per day, while heifers and young cows need to gain 2 to 2.5 lbs per day. Along with fetal and placental growth, cows are preparing for lactation. Late in this period feed intake may decrease because the fetus and associated structures take up space normally occupied by the rumen.

Factors affecting nutrient requirements

The nutrient requirements of beef cows can be broken down into four principal components: Maintenance, Lactation, Growth, and Reproduction. From these components, requirements for energy, protein, minerals, and vitamins are calculated. By understanding the different factors that affect requirements, producers can make adjustments to changes

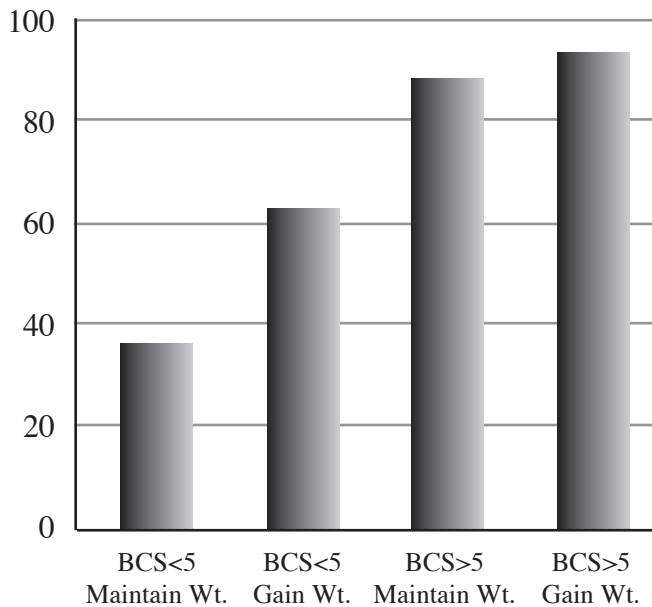


Figure 2. The effects of body condition at calving and postpartum gain on conception rates in heifers.

such as a month of cold weather, moving to a hilly pasture, or the last third of pregnancy.

Maintenance. The maintenance component includes all the nutrients required for the animal to breath, move, digest food, keep warm, repair tissues, and maintain body weight. Weight, age, breed, physiological status, activity, and environmental conditions are the primary variables impacting maintenance requirements. The larger the animal, the greater its maintenance requirement, especially energy and protein. Extremely heavy muscled breeds will have greater maintenance requirements than light muscled breeds. Pregnancy and lactation increase basal metabolism, so maintenance requirements are altered accordingly. Heavy milking breeds have an increased maintenance requirement. Increased activity or rough terrain will increase maintenance energy needs as will extremely cold, hot, wet, or muddy conditions.

Even though all nutrients are needed for maintenance, only energy requirements are divided into maintenance and non-maintenance portions. This division is made because energy is used more efficiently for maintenance than for other body processes such as growth. When net energy (NE) requirements are used instead of TDN, you will notice that there are separate requirements for NEm (maintenance), NEg (gain), and NEl (lactation). Furthermore, the NEm values for feeds are greater than those for NEg.

Lactation. Nutrient requirements for lactation are based on the amount of milk at peak lactation and the composition of the milk. Cows that produce more milk, and milk with more fat and protein, will have higher nutrient requirements.

Growth. Requirements for growth are determined by actual weight, average daily gain (growth rate), weight at maturity, and composition of gain. Composition of gain simply means whether cattle are putting on more muscle or more fat. For example, protein requirements will be higher for young cattle because they are gaining more muscle than fat. When cows need to gain weight to increase their body condition score, this is also considered growth.

Reproduction. Adjustments to requirements for reproduction are based on expected calf birth weight and stage of gestation. Usually, pregnancy does not significantly affect requirements until the last three months of pregnancy when the fetus is growing rapidly.

How to use requirement tables or calculate requirements

There are two ways to determine the nutrient requirements of beef cows and calves. The first and most useful for most producers and Extension personnel is to use pre-calculated tables of nutrient requirements derived from the Nutrient Requirements of Beef Cows (NRC, 1996). Except for unusual circumstances, these tables give sufficiently accurate requirements for beef cows, heifers, and young calves. Tables 1-4 contain simplified tables for the major classes of cattle and nutrients. More detailed tables in terms of milk production and physiological status are available from the Arkansas Cooperative Extension Service (Publication MP 391). Tables 1-4 will provide sufficient accuracy to design feeding programs for most producers. Note that the diet nutrient density requirements in the tables are on a dry matter (DM) basis.

The second method is to use the new Nutrient Requirements of Beef Cows computer program. Nutrient Requirements of Beef Cows (NRC, 1996) brought about dramatic changes in the power, flexibility, and accuracy of determining the nutrient requirements of beef cows. The new formulas and computer program can take into account many factors including breed, weight, body condition, physiological stage, milking ability and composition, environment, etc. Although very powerful, this new program is very complex and cumbersome for producers and Extension personnel who have not had extensive nutritional training or training with the program. If you are interested in using this program, you should contact a trained Extension professional or nutritionist to assist you.

To use Tables 1-4 to determine nutrient requirements of cows use the following steps: 1) Locate the table with the type of animals you want requirements for (i.e. Mature Cow, Pregnant Heifer, etc). 2) Pick the production period of the animal (i.e. Gestation, Post-

partum, etc). 3) Locate the average body weight of the animal and read across. This gives you the animal's daily nutrient needs in pounds per head per day. 4) Look at the required nutrient density line at the bottom of the requirements for that particular production period. This gives you the minimum nutrient density or concentration of nutrients needed in the diet.

Either an Animal's Daily Nutrient Needs or Diet Nutrient Density can be used to design diets to meet the nutritional needs of beef cattle. Because cows are generally allowed to eat all they want, the Diet Nutrient Density Requirements in dry matter are most useful. Basically, if a cow eats all she can consume of a diet containing the required percentage of a nutrient, she will consume the needed amount of that nutrient each day.

Tables 1-4 also indicate a dry matter intake requirement or figure. This figure is a guide to how much 100% dry feed an animal could or should eat. It is not the total pounds of feed in its normal or as fed form an animal could eat.

For example, an 1100 pound cow in the pre-calving period would need to eat 22.7 lbs (dry matter basis) of a feed that was 54.6 TDN and 8.6% crude protein to meet her requirements. You have hay on farm that was 85% DM, 55% TDN, and 10% CP. This meets her needs for energy and exceeds her need for protein; so how much do you need to feed her? Use the following formula:

$$\frac{\text{Lbs DM required}}{\% \text{ DM of the feed}} = \text{Lbs of feed needed}$$

$$\frac{22.7 \text{ Lbs. DM}}{.85} = \text{so you would feed her 26.7 or 27 lbs of hay.}$$

For more assistance with calculating diets or evaluating feeds, contact your County Extension Animal Science Agent.

Example Diets for Beef Cattle

Late gestation cows (1200 lb. Last 60 days of gestation)

1. 30 lbs good quality hay*
2. 30 lbs fair quality hay* plus 1 lb corn
3. Stockpiled fescue
4. 25 lbs 80% poultry litter 20% corn plus 5 lbs poor hay
5. 60 lbs corn silage plus 1 lb protein supplement
6. Good quality fall pasture

Lactating cows (1200 lb. Average milking ability)

1. 32 lbs good hay plus 1 lb corn plus 1 lb protein supplement
2. 32 lbs fair hay plus 5 lbs corn gluten pellets
3. Spring pasture, good quality summer pasture or excellent stockpiled fescue
4. 28 lbs 80% poultry litter 20% corn plus 5 lbs hay
5. 68 lbs silage plus 4 lbs protein supplement

Gestating cows (Mid Gestation)

1. Stockpiled fescue
2. Moderate quality pasture
3. 25 lbs average quality hay
4. Grazing corn stalks plus 1 lb cottonseed meal

Pregnant replacement heifers (Late Gestation)

1. Good quality grass – legume pasture
2. 21 lbs good quality hay plus 6 lbs cracked corn and 1 lb soybean meal
3. 21 lbs good quality hay plus 7 lbs barley
4. 40 lbs corn silage plus 4 lbs whole cottonseed

Pregnant heifers (Mid Gestation)

1. Good quality pasture
2. Stockpiled fescue
3. 22 lbs good quality grass hay plus 3 lbs barley
4. 34 lbs corn silage plus 2 lb soybean meal plus hay

Lactating 1st calf heifers

1. 24 lbs good hay plus 3 lbs corn plus 2 lbs soybean meal
2. 24 lbs good hay plus 6 lbs corn gluten pellets
3. Abundant spring pasture

Young herd bulls (12-24 months)

1. High quality pasture plus 12 lbs corn
2. 20 lbs grass legume hay plus 12 lbs corn
3. 80 lbs corn silage plus 2 lbs protein supplement

Mature herd bulls

1. High quality pasture plus grain if needed
2. 30 lbs of good quality hay plus grain if needed
3. 70 lbs corn silage plus 1.5 lbs protein supplement

* Good quality hay = >56% TDN; >10% CP
Fair quality hay = 50 - 55% TDN; 8 - 9% CP

Table 1.**Daily Nutrient Requirements and Diet Nutrient Densities for Mature Cows****Post Partum - Early Lactation Through Breeding**

Body Weight	Dry Matter Intake, (lb)	Lb Per Animal Per Day				
		TDN	NEm	CP	Ca	P
1100	26.2	15.5	15.7	2.75	0.08	0.05
1200	27.6	16.2	16.3	2.82	0.08	0.06
1300	29.1	17.0	17.2	2.91	0.09	0.06
1400	30.4	17.6	17.6	3.01	0.09	0.06
Required Diet		% TDN	NEm	% CP	% Ca	% P
Nutrient Density		59.2	0.60	10.5	0.30	0.20

Lactating & Pregnant - Late Lactation to Weaning

Body Weight	Dry Matter Intake, (lb)	Lb Per Animal Per Day				
		TDN	NEm	CP	Ca	P
1100	25.1	13.8	13.3	2.18	0.06	0.04
1200	26.5	14.5	14.0	2.28	0.06	0.05
1300	28.0	15.2	14.8	2.35	0.07	0.05
1400	29.4	15.9	15.3	2.44	0.07	0.05
Required Diet		% TDN	NEm	% CP	% Ca	% P
Nutrient Density		55.1	0.53	8.7	0.24	0.17

Gestation - Weaning to 60-90 Days Before Calving

Body Weight	Dry Matter Intake, (lb)	Lb Per Animal Per Day				
		TDN	NEm	CP	Ca	P
1100	21.3	10.1	8.7	1.41	0.03	0.03
1200	22.8	10.8	9.3	1.50	0.04	0.03
1300	24.3	11.5	10.0	1.60	0.04	0.03
1400	25.6	12.1	10.5	1.69	0.04	0.03
Required Diet		% TDN	NEm	% CP	% Ca	% P
Nutrient Density		47.4	0.41	6.6	0.17	0.13

Pre-Calving 60 - 90 Days Before Calving

Body Weight	Dry Matter Intake, (lb)	Lb Per Animal Per Day				
		TDN	NEm	CP	Ca	P
1100	22.7	12.3	20.7	1.93	0.06	0.04
1200	24.4	13.2	22.2	2.07	0.06	0.04
1300	25.8	14.1	23.5	2.22	0.07	0.04
1400	27.3	14.9	25.1	2.35	0.07	0.04
Required Diet		% TDN	NEm	% CP	% Ca	% P
Nutrient Density		54.6	0.92	8.6	0.26	0.16

Table 2.**Daily Nutrient Requirements and Diet Nutrient Densities for 1st Calf Heifers****Post Partum - Early Lactation Through Breeding**

Estimated Mature Weight	Dry Matter Intake, (lb)	Lb Per Animal Per Day				
		TDN	NEm	CP	Ca	P
1100	22.4	13.6	13.9	2.35	0.07	0.04
1200	23.7	14.3	14.7	2.44	0.07	0.05
1300	25.0	15.0	15.5	2.53	0.08	0.05
1400	26.2	15.7	16.2	2.62	0.08	0.05
Required Diet		% TDN	NEm	% CP	% Ca	% P
Nutrient Density		60.6	0.62	10.5	0.31	0.19

Lactating & Pregnant - Late Lactation to Weaning

Estimated Mature Weight	Dry Matter Intake, (lb)	Lb Per Animal Per Day				
		TDN	NEm	CP	Ca	P
1100	22.1	12.6	12.4	1.97	0.06	0.04
1200	23.5	13.4	13.2	2.07	0.06	0.04
1300	24.8	14.1	13.9	2.16	0.06	0.04
1400	26.1	14.8	14.6	2.24	0.07	0.04
Required Diet		% TDN	NEm	% CP	% Ca	% P
Nutrient Density		57.0	0.56	8.9	0.25	0.17

Gestation - Weaning to 60-90 Days Before Calving

Estimated Mature Weight	Dry Matter Intake, (lb)	Lb Per Animal Per Day				
		TDN	NEm	CP	Ca	P
1100	20.5	10.4	9.4	1.48	0.04	0.03
1200	21.9	11.1	10.3	1.60	0.05	0.03
1300	23.3	11.8	11.0	1.70	0.05	0.03
1400	24.6	12.5	11.6	1.80	0.05	0.04
Required Diet		% TDN	NEm	% CP	% Ca	% P
Nutrient Density		50.9	0.47	7.3	0.22	0.15

Pre-Calving 60-90 Days Before Calving

Estimated Mature Weight	Dry Matter Intake, (lb)	Lb Per Animal Per Day				
		TDN	NEm	CP	Ca	P
1100	21.8	12.6	12.4	1.94	0.06	0.04
1200	23.3	13.5	13.5	2.10	0.07	0.04
1300	24.8	14.4	14.4	2.23	0.07	0.04
1400	26.2	15.3	15.2	2.36	0.08	0.05
Required Diet		% TDN	NEm	% CP	% Ca	% P
Nutrient Density		58.3	0.58	9.0	0.30	0.18

Table 3.**Daily Nutrient Requirements and Diet Nutrient Densities for Pregnant Replacement Heifers****Early Gestation - Breeding through Preg Check (1 lb Gain/Day)**

Estimated Mature Weight	Dry Matter Intake, (lb)	Lb Per Animal Per Day				
		TDN	NEm	CP	Ca	P
1100	18.5	9.3	8.5	1.33	0.041	0.032
1200	19.8	10.0	9.1	1.42	0.046	0.036
1300	21.0	10.6	9.8	1.52	0.049	0.038
1400	22.3	11.3	10.5	1.61	0.054	0.040
Required Diet		% TDN	NEm	% CP	% Ca	% P
Nutrient Density		50.8	0.47	7.2	0.24	0.18

Mid Gestation(1-1.25 Lb. Gain/Day)

Estimated Mature Weight	Dry Matter Intake, (lb)	Lb Per Animal Per Day				
		TDN	NEm	CP	Ca	P
1100	20.1	10.4	9.7	1.48	0.044	0.034
1200	21.5	11.1	10.3	1.58	0.047	0.037
1300	22.9	11.8	11.0	1.68	0.050	0.041
1400	24.2	12.5	11.6	1.78	0.054	0.044
Required Diet		% TDN	NEm	% CP	% Ca	% P
Nutrient Density		51.7	0.48	7.4	0.22	0.18

Late Gestation - Pre-Calving (1.5-2.25 Lb. Gain/Day)

Estimated Mature Weight	Dry Matter Intake, (lb)	Lb Per Animal Per Day				
		TDN	NEm	CP	Ca	P
1100	22.2	12.7	12.6	1.95	0.069	0.050
1200	23.7	13.4	13.2	2.05	0.073	0.053
1300	25.2	14.2	13.9	2.17	0.076	0.056
1400	26.6	15.0	14.7	2.27	0.081	0.059
Required Diet		% TDN	NEm	% CP	% Ca	% P
Nutrient Density		56.2	0.55	8.0	0.30	0.22

Table 4.**Daily Nutrient Requirements and Diet Nutrient Densities for Breeding Bulls****1700 Lb Mature Weight Bull Gaining 1.5 Lbs/Day**

Dry		Lb Per Animal Per Day					
Current Weight	Matter Intake, (lb)	TDN	NEm	NEg	CP	Ca	P
1300	30.7	18.4	10.6	4.6	1.85	.057	.037
1400	32.4	19.4	11.2	4.9	1.88	.057	.039
1500	34.1	20.5	11.8	5.1	1.92	.058	.040
1600	35.8	21.5	12.4	5.4	1.95	.059	.041
Required Diet		% TDN	NEm	NEg	% CP	% Ca	%P
Nutrient Density		60.0	0.61	0.35	6.0	.19	.12

1700 Lb Mature Weight Bull Gaining 0-0.5 Lbs/Day

Dry		Lb Per Animal Per Day					
Current Weight	Matter Intake, (lb)	TDN	NEm	NEg	CP	Ca	P
1600	33.9	17.0	12.4	1.36	1.84	.054	.039
1700	35.8	17.8	13.0	1.42	1.91	.052	.040
Required Diet		% TDN	NEm	NEg	% CP	% Ca	%P
Nutrient Density		50.0	.45	.20	5.5	.16	.12

2000 Lb Mature Weight Bull Gaining 1.7 Lbs/Day

Dry		Lb Per Animal Per Day					
Current Weight	Matter Intake, (lb)	TDN	NEm	NEg	CP	Ca	P
1500	34.1	20.5	11.8	5.1	2.10	.066	.043
1600	35.8	21.5	12.4	5.4	2.10	.066	.044
1700	37.5	22.5	13.0	5.6	2.15	.066	.046
1800	39.1	23.5	13.5	5.9	2.18	.067	.047
1900	40.8	24.5	14.0	6.1	2.2	.068	.047
Required Diet		% TDN	NEm	NEg	% CP	% Ca	%P
Nutrient Density		60.0	0.61	0.35	6.0	.19	.12

2000 Lb Mature Weight Bull Gaining 0-0.5 Lbs/Day

Dry		Lb Per Animal Per Day					
Current Weight	Matter Intake, (lb)	TDN	NEm	NEg	CP	Ca	P
1900	36.6	19.3	14.1	1.54	2.10	.063	.047
2000	37.2	20.1	14.6	1.60	2.10	.063	.047
Required Diet		% TDN	NEm	NEg	% CP	% Ca	%P
Nutrient Density		50.0	0.46	0.20	5.5	.16	.12