A2387

Rations for Beef Cattle

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To produce beef efficiently, cattlemen know it's important to feed their animals nutritionally balanced rations. Since feed accounts for 60–80% of total production costs, producers should formulate balanced rations as economically as possible. The amount and kind of feed needed varies by year, and by the needs of different cattle. This variability makes it difficult for individual beef producers to calculate their own least-cost nutritionally balanced rations.

This publication gives examples of nutritionally balanced rations for beef cattle of different classes and weights using commonly available feeds. You can choose the ration for the class and weight of your cattle based on the information in tables 1 through 7. These rations estimate the amount of feed used daily, daily gains, and feed efficiencies as well as energy and crude protein levels. Select the ration that uses feeds available on your farm and that will produce the desired rate of gain.

If you need additional information, the University of Wisconsin–Extension offers producers the *Taurus Beef Ration Balancing and Profit Projection Program*. This program combines the latest nutritional knowledge with computer technology and can be used to calculate least-cost balanced rations and profit projections for your specific needs.

Starting cattle on feed

Cattle producers strive to put cattle on a full feed of grain as soon as possible, but problems can result from working cattle up to a full feed too quickly. Cattle can be started on rations containing 50% grain with few problems; however, increasing grain intake to full feed (85–90% concentrate) too rapidly, without allowing the rumen time to adjust, can cause problems.

The cattle's rumen converts roughage of variable quality into energy and protein in a process called microbial fermentation. Economics have forced producers to push this intricate process to the limit by feeding cattle large quantities of high energy feedstuffs that exploit microbial fermentation to its full potential.

The proportion of grain in a ration that cattle can accept without going off feed depends on many factors, including pen size, feeder space, weather, disease, size and age of cattle. A typical schedule for starting cattle on feed follows.

Suggested schedule for adjusting cattle to a high grain diet.

% Grain in ration	% Forage in ration	Days fed
50	50	First 5–7 days
70	30	Next 3–5 days
80	20	Next 3–5 days
85	15	Next 5–7 days
90	10	Until finished

Using this "step-up" method gets cattle on feed uniformly and efficiently. It also minimizes the potential for creating metabolic disorders associated with cattle on a high grain diet. Severe metabolic disorders will lead to acidosis, founder, liver abscesses and sudden death. If there is a problem with metabolic disorders you must reduce the amount of grain. Usually, stepping down to the next lower grain ration will correct the problem until the cattle are back on feed. Once the cattle have established normal feed consumption they can be moved up to the finisher diet.

Ionophores and growth promoters

Adding ionophores to cattle feed is a practice widely used in the cattle industry. Ionophores improve nutrient availability and decrease feed per pound of gain in high-grain rations by about 10%. On forage rations, ionophores improve the rate of gain by about 10–15%. Tables 1 through 5 assume the addition of an ionophore. If an ionophore is not added, decrease the rates of gain by 10% in tables 1 and 2, but increase feed per pound of gain by 10% for all rations shown in tables 3, 4 and 5. Ionophores are not included in the rations shown in tables 6 and 7.

Growth promoters are also widely used in the beef feeding business. They increase the rate of gain and feed efficiency by 10–20%. Growth promoters are placed beneath an animal's skin on the back of the ear. Some feed additives claim to be growth promoters; you must follow feeding instructions on these substances carefully. Make sure to observe the recommended withdrawal times with feed-grade growth promoters. Ear implant promoters have no withdrawal times if used as directed.

The estimated rates of gain and feed efficiencies listed in tables 1 through 5 assume the use of a growth promoter. If this is not the case, the estimated rates of gain and feed efficiency will be about 15% less than listed.

If neither an ionophore nor a growth promoter is used, reduce the rates of gain and feed efficiency shown in the tables by 15–20%.

Both ionophore and growth promoters are discussed in detail in the the Extension publication *Optimizing Tools for Feedlot Production* (A3661) available at the address on the back cover.

Protein and non-protein nitrogen

The quality of protein, or balance of essential amino acids, is not a critical factor in most beef cattle finishing rations, because bacteria in the rumen "manufacture" the proteins that cattle use.

Choose a protein supplement by comparing the price of a pound of protein in the supplements that are available. The leading protein supplements for finishing cattle are soybean meal, cottonseed meal, linseed meal and urea, or slow-released nonprotein nitrogen products.

Although cattle can convert some excess protein in the ration can to energy, each 1% increase in protein above the required level may increase the cost of gain by ¼ –½ cent per pound. However, underfeeding protein can cost much more than overfeeding because of the resulting slow gains and poor feed efficiency.

Protein required by cattle, measured as pounds of protein per day, increases with an animal's weight. The protein requirement of cattle is usually expressed as a percent of the ration. This percentage decreases as animals get older and heavier because the amount of feed they consume daily increases faster than their protein needs. Thus, a young calf requires a ration containing 16–20% protein, a yearling steer needs a ration containing 11–13% protein and a mature cow needs only 7–9% protein.

Non-protein nitrogen (NPN) is useful as a protein source because rumen microbes use ammonia to grow. The microbes are a source of protein when they are digested in the animal's lower digestive tract. The amount of microbial protein produced daily increases with age, size and the energy density of the ration.

Common sources of NPN include urea, ammonium phosphate and anhydrous ammonia. All sources of NPN are used most efficiently in high-energy rations.

Older and larger cattle use NPN sources more efficiently as a protein source than younger and smaller animals. Since young calves do not produce enough microbial protein to meet requirements, NPN sources will not support maximum growth rates for them. As cattle grow, they become capable of producing more microbial protein while the amount of protein required for growth from the diet decreases.

Large-framed calves weighing less than 600 lbs need ruminal escape protein sources in rations for rapid, efficient growth. Yearlings weighing 600–800 lbs can use approximately half of the supplemental protein as non-protein nitrogen. The remaining supplemental protein should be natural. Cattle weighing more than 800 lbs can receive all of their supplemental protein from NPN sources. Mature beef cows can use all NPN supplemental protein, if any is needed.

Minerals

Most ordinary rations contain adequate amounts of most minerals and those that are limited can be easily supplemented. Trace-mineralized salt supplies sodium, chlorine, iron, copper, zinc and manganese. Offer trace-mineral salt as a free choice at all times. Many mineral mixtures also contain selenium.

Supplemental calcium, phosphorus, potassium, magnesium and sulfur may be required with certain rations. Grains contain little calcium, so more must be added to high-grain than to high-forage rations. Alfalfa is very high in calcium, but grains, grasses and corn silage are severely deficient or contain only limited amounts of calcium.

Dicalcium phosphate is a good source of supplemental phosphorus. Limestone is used with dicalcium phosphate in rations containing large amounts of grains and corn silage.

Magnesium deficiency may be a problem when cattle graze highly fertilized grass pastures. Rations containing large amounts of non-protein nitrogen are commonly supplemented with sulfur. All-grain rations require additional potassium.

Mineral mixtures frequently contain varying amounts of these minerals. Feedlot rations are generally supplemented with a mineral containing 8% calcium and 3–5% phosphorus.

Equal parts of limestone, dicalcium phosphate and trace-mineral salt make an economical mineral mixture for feedlot cattle. For cattle on pasture, an economical mixture consists of equal parts of dicalcium phosphate and trace-mineral salt.

Vitamins

Beef cattle require few supplemental vitamins. Rumen microbes usually produce enough B vitamins to satisfy requirements. Vitamins A, D and E are frequently supplemented, primarily because they are economical and ensure against deficiencies.

Ruminants make vitamin A from plant pigments called carotene. Large amounts of vitamin A are then stored in the liver. Vitamin A deficiencies can occur when body reserves are depleted. This may happen when animals are under stress (disease), graze droughty pastures or consume sun-bleached feeds. Silages contain less potential vitamin A than fresh-cut forages because the ensiling process changes carotene, making it impossible for cattle to use.

The general recommendation is to supply 30,000 International Units (IU) of vitamin A per head per day.

Vitamin D is produced by the effects of sunlight on hay and on the animal's body. Cattle fed sun-cured hay or allowed outside in the sunlight receive enough vitamin D. This vitamin is commonly combined with vitamin A in a ratio of approximately 10 units of vitamin A to 1 unit of vitamin D. Beef cattle need about 3,000 IU of vitamin D per head per day.

Vitamin E is usually supplied in adequate amounts by natural feedstuffs. Green, leafy forages are particularly rich in this vitamin; silages contain variable amounts. Beef cattle require less than 100 IU of vitamin E per head per day.

The common supplementation ratio for vitamins A, D and E is 100:10:1.

Rations for various ages and classes of beef cattle

To estimate the total feed required when rations in two or three consecutive tables are used, multiply the amount fed daily by the number of days each ration is fed. Then add these amounts.

For example, total feed requirements of steer calves from 350–1,100 lbs can be estimated by adding feed allowances for the rations selected from tables 1, 2 and 3.

The rations are designed to be fed at least once a day. Feed to appetite except for dry, pregnant cows where feed may be wasted if the cows are offered free choice. Actual feed consumption may differ from that indicated in the tables. The estimated feed consumption and feed efficiency are based on pounds of feed consumed. Provide loose trace-mineral salt and mineral free choice with all rations.

Table 1. Rations for growing and finishing heifer and steer calves: 350 to 550 lbs.

	Rations									
Feedstuffs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	lbs/day									
No. 2 shelled corn							5.0		5.0	11.0
Ear corn				5.0		5.0		5.0		
Oats					5.0					
Corn silage			28.5					17.5	17.5	
Haylage		23.0				15.5	15.5			
Alfalfa hay	13.5			9.0	9.0					
Protein supplement, 32%	0.5	0.5	2.0	0.5	0.5	0.5	0.5	1.5	1.5	1.5
Est. lb fed daily[1]	14.0	23.5	30.5	14.5	14.5	21.0	21.0	24.0	24.0	12.5
Est. daily gain[2]	0.8	1.1	2.0	1.5	1.4	1.8	1.9	2.2	2.3	3.1
Est. feed/lb,gain[3,4]	17	12	6.6	8.7	9.5	7.1	6.4	5.8	5.4	3.9
Mcal NEg/lb[4]	.21	.29	.43	.34	.32	.39	.42	.47	.49	.62
%TDN[4]	55.0	52.0	71.7	69.4	64.4	65.3	65.5	78.6	79.0	88.9
%CP[4]	18.7	17.6	12.0	15.5	17.0	14.8	15.0	12.0	12.0	13.5

[1] As-fed moisture basis. Includes a 5% waste for grain and 10% waste for forage.
[2] Expected steer gains. Heifers gain 8–10% less.
[3] Feed efficiencies for steers. Heifers require approximately 2–5% more feed.
[4] Dry matter basis. Mcal NEg/lb=calories for gain; %TDN=percent total digestible nutrients; and %CP=percent crude protein.

Growing and finishing heifer and steer calves (350–550 lbs)

Table 1 shows rations for growing and finishing 350- to 550-lb heifer and steer calves. Rations 1 and 2 are not recommended for calves weighing less than 350 lbs. These rations contain too much fiber and are too low in energy for young calves to make adequate gains.

Rations 3 through 7 are recommended for replacement heifer calves and steer calves that will be pastured the following summer. Replacement heifers should not receive growth implants. Ration 8, 9 and 10 are for large-framed calves that need to receive higher levels of nutrition until they reach market weight.

Allow a minimum of 10–12 inches of bunk space per calf for cattle listed in tables 1–4. Remove spoiled feed daily.

You may substitute oats for ear corn on an equal dry matter weight basis—up to 40% of the total grain may be oats. High-moisture ear or shelled corn can be substituted for dry corn of the same type on an equal dry matter basis. Whole shelled corn is recommended for ration 10, while cracked corn is recommended for the other rations.

Mixed legume-grass hay can be substituted for an equal weight of alfalfa hay. Hay and haylage can substitute for each other on a dry matter basis.

Table 2. Rations for growing and finishing heifer and steer calves: 550 to 750 lbs.

	Rations									
Feedstuffs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	lbs/day									
No. 2 shelled corn							7.0		7.0	16.5
Ear corn				7.0		7.0		7.0		
Oats					7.0					
Corn silage			38.5					26.5	26.5	
Haylage		33.0				22.0	22.0			
Alfalfa hay	19.0			12.0	12.0					
Protein supplement, 32%	0.5	0.5	2.0	0.5	0.5	0.5	0.5	1.5	1.5	1.5
Est. lb fed daily[1]	19.5	33.5	40.5	19.5	19.5	29.5	29.5	35.0	35.0	19.0
Est. daily gain[2]	0.9	1.4	2.2	1.7	1.6	2.0	2.2	2.5	2.6	3.4
Est. feed/lb,gain[3,4]	21.5	13.6	8.3	10.8	11.7	9.0	8.1	7.2	6.7	4.9
Mcal NEg/lb[4]	.21	.29	.43	.34	.32	.39	.42	.48	.50	.64
% TDN[4]	55.0	52.0	71.3	73.9	65.1	69.2	65.5	76.4	73.6	90.1
%CP[4]	18.4	17.5	11.5	15.3	16.8	14.7	15.2	11.0	11.0	12.4

[1] As-fed moisture basis. Includes a 5% waste for grain and 10% waste for forage.

[2] Expected steer gains. Heifers gain 8–10% less.

[3] Feed efficiencies for steers. Heifers require approximately 2–5% more feed.

[4] Dry matter basis. Mcal NEg/lb=calories for gain; %TDN=percentage total digestible nutrients; and %CP=percent crude protein.

Growing and finishing heifer and steer calves (550–750 lbs)

Table 2 shows rations for growing and finishing 550- to 750-lb heifers and steers. Ration 2 is not strongly recommended unless the daily gain of replacement heifers or steers to be pastured the following summer exceeds those estimated here. Ration 1 and rations 3 through 7 are recommended for replacement heifers and wintering steers to be pastured the following summer. Rations 8, 9 and 10 are recommended for large-framed animals that need to receive high levels of nutrition until they reach market weight.

Remove spoiled feed daily. Grain and forage substitutions outlined in table 1 may be used.

Table 3. Rations for finishing yearling steers: 600 to 1200 lbs

	Rations									
Feedstuffs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	lbs./day									
No. 2 shelled corn	2	4	6				14	16	19	20
Ear corn				16	18	22				
Corn silage	20	16	12	4	6		8	6		
Haylage	16	16	16	6			6	4	4	2.0
Alfalfa hay										
Protein supplement, 32%	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Est. lb fed daily[1]	39	37	35	27	24	23	29	27	24	23.0
Est. daily gain[2]	2.0	2.1	2.2	2.5	2.7	2.9	2.7	3.0	3.1	3.2
Est. feed/lb,gain[3,4]	10.0	9.5	9.0	8.3	6.9	6.8	6.9	6.6	6.2	6.1
Mcal NEg/lb[4]	.39	41	44	52	56	58	56	59	63	.65
%TDN4	66	68	70	80	82	83	82	84	87	90
%CP4	13.5	14	14	12.1	11	11	12.3	12	12.2	12.0

[1] As fed-moisture basis. Includes a 5% waste for grain and 10% waste for forage.
[2] Expected steer gains.
[3] Feed efficiencies for steers. Heifers require approximately 2–5% more feed.
[4] Dry matter basis. Mcal NEg/lb=calories for gain; %TDN=percent total digestible nutrients; and %CP=percent crude protein.

Finishing yearling steers (600–1200 lbs)

Table 3 shows rations for 600- to 1200-lb finishing yearling steers. Rations 4 and 5 may be used when grain prices become high but these rations will not achieve the performance obtained from higher grain diets.

Remove spoiled feed daily. Grain and forage substitutions outlined for table 1 can be used.

Table 4. Rations for finishing yearling heifers: 550 to 1050 lbs.

	Rations									
Feedstuffs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	lbs/day									
No. 2 shelled corn		19.0	18.5	7.5			17.0	13.5	12.0	22.0
Ear corn	19.5				7.5	17.0				
Corn silage				30.0	39.5	16.5	16.5	16.5	16.5	
Haylage			11.0	11.0					11.0	
Alfalfa hay	5.5	5.5						5.5		
Protein supplement, 32%	0.5	0.5	0.5	0.5	2.0	1.5	1.0	0.5	0.5	1.0
Est. lb fed daily[1]	25.5	25.0	30.0	49.0	49.0	35.0	34.5	36.0	40.0	23.0
Est. daily gain[2]	2.3	2.7	2.7	2.0	2.0	2.4	2.9	2.3	2.3	3.0
Est. feed/lb,gain[3,4]	9.5	8.1	8.0	10.4	10.4	9.1	7.8	9.5	9.5	6.7
Mcal NEg/lb[4]	.51	.56	.57	.46	.47	.53	.58	.50	.50	.65
% TDN[4]	83.1	83.7	81.6	72.1	76.9	84.2	85.0	78.5	76.2	90.5
%CP[4]	11.5	12.7	12.6	10.9	10.1	10.1	10.6	11.6	11.6	11.7

[1] As-fed moisture basis. Includes a 5% waste for grain and 10% waste for forage.

[2] Expected steer gains. Heifers gain 8–10% less.

[3] Feed efficiencies for steers. Heifers require approximately 2–5% more feed.

[4] Dry matter basis. Mcal NEg/lb=calories for gain; %TDN=percentage total digestible nutrients; and %CP=percent crude protein.

Finishing yearling heifers (550–1050 lbs)

Table 4 shows rations for finishing 550- to 1050-lb yearling heifers. None of these rations are recommended for replacement heifers as heifers may become too fat.

Remove spoiled feed daily. Grain and forage substitutions outlined in table 1 can be used.

Table 5. Rations for dry, pregnant cows and heifers: 900 to1300 lbs

	Rations									
Feedstuffs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	lbs/day									
Corn silage							22.5	22.5	40.0	
Corn stalk silage					33.5	33.5				
Sweet corn waste silage			64.0	33.5						
Haylage		40.0			20.0		20.0			
Alfalfa hay	18.5			10.5		10.5		10.5		10.5
Oat straw										12.0
Protein supplement, 32%									1.0	
Est. lb fed daily[1]	18.5	40.0	64.0	44.0	53.5	44.0	42.5	33.0	41.0	22.5
%TDN[2]	56.0	53.0	72.0	64.0	55.0	57.0	60.0	63.0	70.0	54.0
%CP[2]	16.0	17.6	8.8	13.4	11.0	12.6	12.2	13.7	10.0	10.9

[1] As-fed moisture basis. Includes a 5% waste for grain and 10% waste for forage.

[2] Dry matter basis. See table 1 footnote.

Dry, pregnant cows and heifers (900–1300 lbs)

The rations in table 5 are for 900- to 1300-lb heifers and dry, pregnant cows. These rations should maintain body weight on cattle in average condition. Feed first-calf heifers and thin cows separately from the main cow herd. Do not let pregnant cows get too thin.

Table 6. Rations for lactating cows and heifers: 900 to1300 lbs.

	Rations									
Feedstuffs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	lbs/day									
Corn										2.5
Corn silage							27.5	27.5	53.0	
Corn stalk silage					38.5	38.5				
Sweet corn waste silage			70.0	33.5						
Haylage		53.0			26.5		26.5			
Alfalfa hay	28.0			13.5		13.5		13.5		13.5
Oat Straw										11.0
Protein supplement, 32%			1.0						2.0	
Est. lb fed daily[1]	28.0	53.0	71.0	46.5	65.0	52.0	54.0	41.0	55.0	27.0
% TDN[2]	55.0	53.0	59.0	64.0	55.0	57.0	60.0	63.0	71.0	56.0
%CP[2]	16.0	17.6	10.2	13.9	11.6	12.8	12.4	13.7	10.7	12.0

[1] As-fed moisture basis. Includes a 5% waste for grain and 10% waste for forage.

[2] Dry matter basis. See table 1 footnote.

Lactating cows and heifers (900–1300 lbs)

The rations in table 6 should maintain body weight on lactating cows and heifers in average condition. Rations 3, 5 and 6 are not recommended unless cows are over-conditioned. Cows in average condition may get too thin on rations 5 and 6. Feed first-calf heifers and thin cows separately from the main cow herd. Do not let lactating cows get too thin. Feed cows free choice.

Table 7. Rations for bulls: 1100 to 2000 lbs.

	Rations									
Feedstuffs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	lbs/day									
Oats									12.5	12.5
Corn silage							33.0	33.0		
Corn stalk silage					47.5	47.5				
Sweet corn waste silage			75.0	44.0						
Haylage		61.5				31.0		31.0		31.0
Alfalfa hay	32.0			13.5		16.5		16.5		16.5
Protein supplement, 32%			1.0							
Est. lb fed daily[1]	32.0	61.5	76.0	57.5	78.5	64.0	64.0	49.5	43.5	29.0
%TDN[2]	57.0	53.0	72.0	65.0	55.0	57.0	60.0	62.0	62.0	65.0
%CP[2]	16.0	17.6	9.5	13.3	11.5	12.9	12.3	13.8	14.5	16.2

[1] As-fed moisture basis. Includes 10% waste.

[2] Dry matter basis. See table 1 footnote.

Bulls (1100–2000 lbs)

The rations in table 7 should maintain body weight on 2-year-old bulls and mature bulls in average condition. Rations 2, 3, 5 and 6 are not recommended for yearling bulls. Yearling bulls need more energy for growth before breeding than these rations provide. Bulls should be in good flesh before breeding season, but do not allow them to get too fat. Feed young bulls separately from older bulls.

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