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Rations for growing and finishing beef cattle

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Formulating a ration is a matter of combining feeds to make a ration that will be eaten in the amount needed to supply the daily nutrient requirements of the animal.

In addition to being nutritionally adequate, a good cattle ration should be economical, palatable and free of toxic substances. Efficiency is increased when rations are consumed at a level to supply a larger amount of energy in relation to body weight. Cattle on full feed usually gain faster and require less feed energy for a pound of gain when they consume high-energy rations. This is due to a larger daily energy intake on this type of ration, which results in a larger percentage of the daily energy being left for gain after body maintenance requirements have been met.

Whether high-energy rations composed largely of grain produce cheaper gains than lower-energy rations depends on the price of grains and roughages in relation to their nutritive content.

National Research Council recommendations of daily nutrients needed by cattle to achieve a specified rate of gain are given in University of Missouri Agricultural Guide 2067, "Daily Nutrient Requirements of Beef Cattle." The nutrient compositions of some feeds commonly fed to beef cattle are listed in MU Agricultural Guide 2051, "Feed Composition Tables."

The computer is useful in building a ration with those feeds that meet the nutritional requirements of the animal at the lowest cost. Missouri cattle feeders can obtain the services of a computer for ration computation through the University of Missouri-Columbia Extension Division.

Some examples of beef cattle rations for different feeding and management systems are given in Tables 1 and 2.

Determining Protein Needs

The daily protein requirements of cattle and the percentage of protein needed in the ration are given in NRC tables. A larger percentage of protein is needed in rations with higher energy density. This is because fewer pounds of the high-energy ration are needed daily to meet the animal's energy requirement, but the protein need stays the same.

Cost per unit of protein should be the primary consideration when buying protein supplements for cattle. In addition, the value of **needed** minerals, vitamins and other additives has a bearing on choices. The percent of the protein value that is derived from non-protein nitrogen (NPN) should be considered because some reduction in performance will occur when large amounts on non-protein nitrogen are used with low-energy rations.

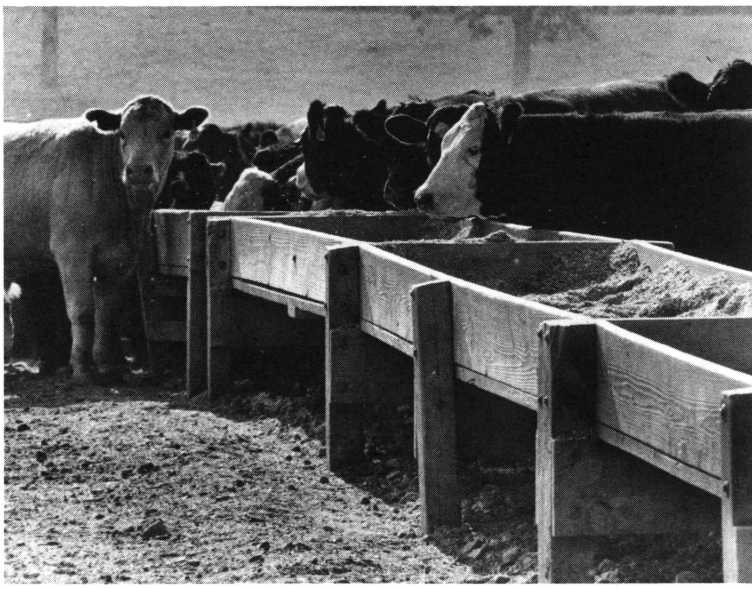

Table 1. Rations for growing and finishing beef cattle.

A. Wintering rations for calves to go to pasture 1.25 to 1.50 lbs. per head gain daily)

	Lbs.
1. Silage and protein supplement:	
Silage	25-35
Protein (44%)	1
Mineral mix*	Free choice
Salt, 1 part	
Dicalcium phosphate, 1 part	
2. Silage and legume hay:	
Silage	20-30
Hay (legume)	5
Mineral mix*	Free choice
Salt, 1 part	
Dicalcium phosphate, 1 part	
3. Hay and Grain:	
Grain	2-4
Hay ($^1/_2$ legume)—full fed	10-14
Mineral mix*	Free choice
Salt, 1 part	
Monosodium phosphate,	
or	
Dicalcium phosphate, 1 part	

B. Wintering rations for calves to be fattened shortly after wintering period (1.75 to 2.00 lbs. per head gain daily).

	Lbs.
1. Silage and protein supplement:	
Grain	0-3
Silage—full fed	25-35
Protein (44%)	1.25
Mineral mix*	Free choice
Salt, 1 part	
Dicalcium phosphate, 1 part	
Limestone, 1 part	
2. Hay and Grain:	
Hay (at least $^1/_2$ legume)	8-10
Grain (1 lb./100 lbs. body wt.)	5-7
Protein (44%)	.5
Mineral mix*	Free choice
Salt, 1 part	
Dicalcium phosphate, 1 part	

Table 2. Complete mixed rations (as fed).

Ration A. Corn, soybean meal, alfalfa hay.

Expected Daily Gain	No. 1# 2.5	No. 2# 2.75	No. 3# 3.0
Ground shelled corn	59.50	72.40	85.25
Soybean meal	-	-	1.50
Alfalfa hay	40.00	27.00	12.00
Dicalcium phosphate	.15	.10	
Limestone	-	.15	.65
Potassium chloride	-	-	.25
Salt, trace mineral	.35	.35	.35
	100.00	100.00	100.00
Composition, dry matter	%	%	%
TDN	75.85	80.30	85.00
Protein	12.85	11.80	11.35
Ca	.60	.50	.46
P	.30	.30	.29
K	.89	.71	.72
Salt	.36	.36	.36

Ration B. Corn, soybean meal, corn silage.

Expected Daily Gain	No. 1# 2.5	No. 2# 2.75	No. 3# 3.0
Ground shelled corn	8.90	33.00	62.00
Soybean meal (45%)	2.60	2.50	2.70
Corn silage (33% DM)	88.00	63.75	34.00
Dicalcium phosphate	.10	.05	-
Limestone	.25	.50	.80
Potassium chloride	-	-	.25
Salt, trace minerals	.15	.15	.25
	100.00	100.00	100.00
Composition, dry matter	%	%	%
TDN	73.61	80.87	85.23
Protein	10.90	10.86	10.93
Ca	.48	.48	.48
P	.31	.30	.30
K	.90	.66	.70
Salt	.34	.34	.34

C. Finishing Rations

1. Shelled corn-corn silage:

	Lbs.
Ground shelled corn (1-1.5 lbs./ 100 lbs. body wt.)	8-15
Protein (44%)	1.5
Corn silage	Full fed
Mineral mix*	Free choice
Salt, 1 part	
Limestone, 1 part	
Dicalcium phosphate, 1 part	

2. Shelled corn-corn silage:

Ground shelled corn	Full fed
Protein (44%)	1.5
Corn silage	5-10
Mineral mix*	Free Choice
Salt, 1 part	
Limestone, 2 parts	
Dicalcium phosphate, 1 part	

3. Shelled corn-grass hay:

	Lbs.
Shelled corn	Full fed
Hay (grass)	4-6
Protein (44%)	1.5
Mineral mix*	Free choice
Limestone, 2 parts	
Salt, 1 part	
Dicalcium phosphate, 1 part	

4. Shelled corn-legume hay:

Ground shelled corn	Full fed
Hay (legume, good-quality)	4-6
Protein (44%)	1
Mineral mix*	Free choice
Salt, 1 part	
Dicalcium phosphate, 1 part	

*Use trace mineral salt. You may substitute bonemeal for dicalcium phosphate and tripolyphosphate for monosodium phosphate.

Ration C. Corn, soybean meal, urea & fescue hay.

Expected Daily Gain	No. 1# 2.5	No. 2# 2.75	No. 3# 3.0
Ground shelled corn	63.35	77.16	87.00
Soybean meal	.80	-	-
Urea (281 protein equiv.)	.40	.44	.44
Fescue hay	34.30	21.00	10.00
Dicalcium phosphate	.10	.10	-
Limestone	.70	.80	1.0
Potassium chloride	-	.15	.35
Salt, trace mineral	.35	.35	.35
	100.00	100.00	100.00
Composition, dry matter	%	%	%
TDN	74.91	80.24	84.57
Protein	10.82	10.80	10.96
Ca	.46	.45	.47
P	.29	.30	.29
K	.83	.71	.67
Salt	.36	.36	.36

Add recommended levels of vitamins, ionophores (Rumensin® or Bovatec®) and MGA® to rations. See MU Agricultural Guide 2075 "Feed Additives."

Oil meals—soybean, cottonseed and linseed—are of approximately equal value per unit of protein for cattle. Many good commercial supplements and premixes are available. Good formulas for premixes and protein mixtures are available from agricultural experiment stations if you prefer to mix them yourself.

Urea and non-protein nitrogen

Urea and other non-protein nitrogen compounds can be used to replace part of the protein in ruminant rations. Non-protein nitrogen compounds are converted to protein by bacteria in the rumen. Use of urea or other NPN compounds can often reduce protein costs.

A mixture of six parts ground shelled corn and one part urea is approximately equal in energy and protein equivalent to seven pounds of a 44 percent supplement. Use this as a guide for comparing costs.

Liquid and dry urea supplements appear to be equal in value for beef cattle. See MU Agricultural Guide 2071, "Urea Supplements for Beef Cattle."

The available energy level of the ration limits the efficiency of cattle in using urea as a replacement for plant protein. All of the supplemental protein may be

furnished by urea with good results when high-energy finishing rations are fed. When low-energy growing rations are used, urea may need to be limited to not over half of the protein value in the supplement for best economy.

More urea can be used if the natural protein in the supplement has low degradability in the rumen of the cattle (high bypass protein). Examples of high rumen bypass proteins are blood meal, corn gluten meal and hydrolyzed feather meal. Low bypass protein, those highly degradable in the rumen, include soybean meal, corn gluten feed and alfalfa hay.

Minerals

The major mineral considerations in cattle rations are calcium, phosphorus, potassium and salt. Trace minerals such as iodine, copper, cobalt, zinc and selenium have been shown deficient sometimes in feedstuffs used in practical cattle rations. Sulfur additions to urea supplements have been beneficial in some trials. See MU Agricultural Guides 2080 and 208l on minerals.

Selenium may be deficient for cattle and sheep in grains, crop wastes, fescue and other grasses grown on certain Missouri soils. Selenium supplementation increased the daily gain of steers grazing summer fescue pasture at the MU Research Farm. See MU Agricultural Guide 2080 for information on adding selenium to beef cattle rations.

Alfalfa and other legumes are high in calcium. Grains are deficient in calcium but nearly adequate in phosphorus. When fed with grass hay or silage, high-grain rations require more calcium than phosphorus supplementation to correct deficiencies and keep the calcium-phosphorus ratio between 1:1 and 2:1. Limestone is a source of calcium. Bonemeal and dicalcium phosphate supply both calcium and phosphorus.

Mineral deficiencies can be corrected: 1) by mixing a good source of the missing or deficient minerals into a complete ration; 2) by adding minerals to the protein supplement; or 3) by feeding minerals free-choice, separate from the ration. The last is a satisfactory method under most conditions, but some animals will over-consume minerals, while others may eat less than they need.

Vitamins

Vitamin needs of beef cattle are chiefly A, D and E. Bacteria in the rumen of cattle are considered to have the ability to synthesize vitamin K and the B-vitamins in sufficient quantities to meet the animal's requirement. An exception would be a need for B-vitamins in the receiving ration of stressed feeder cattle. Niacin has improved the performance of feedlot cattle on high-grain rations in some studies.

The most important vitamin to consider in cattle feeding is vitamin A. Normally, feeding 15,000 to 30,000 I.U. of vitamin A per head daily will supply ample vitamin A for feedlot cattle.

Vitamin D additions are normally unnecessary in the ration if animals are exposed to sunlight. A deficiency might occur in winter during long periods of cloudy weather.

Most rations fed to beef cattle in Missouri are adequate in vitamin E. Adding two to five I.U. of vitamin E per pound of high-grain rations devoid of leafy roughages has increased feedlot cattle performance in a few Corn Belt trials, but not in others. Injecting new feeder cattle with vitamin E may reduce the incidence and severity of sickness in the starting phase.

MU Agricultural Guide 2058, "Vitamins for Beef Cattle," outlines conditions and levels of vitamins A, D and E supplementation for beef cattle.

Additives and implants

Numerous feed additives are available for cattle rations. See MU Agricultural Guide 2090, "Growth Stimulants," and MU Agricultural Guide 2075, "Feed Additives."

Melengestrol Acetate (MGA® is a hormone material added to the ration of feedlot heifers. It improves rate of gain and feed utilization and suppresses estrus in feedlot heifers. Rate of gain was improved 10.3 percent and feed efficiency 6.5 percent in an average of 47 trials. MGA® may be combined with Rumensin or Bovatec in supplements or rations offered to heifers.

Rumensin® and Bovatec® are feed additives that change rumen fermentation and improve the feed conversions of feedlot cattle by approximately 8 to 10 percent. Both are effective for steers and heifers fed growing or finishing rations. They give some protection against acidosis and founder when cattle are fed high-grain rations. Rumensin® has reduced feed intake with little change in rate of gain for cattle fed high-grain rations. Bovatec® has shown some improvement in daily gain for cattle fed high-energy rations.

Rumensin® has increased rate of gain and feed efficiency of cattle fed corn silage and other roughage rations. Cattle on pasture or those fed high-roughage rations have gained an average of 0.2 pounds more a head daily and had about a 15 percent improvement in feed efficiency when fed Rumensin®. Similar results can be expected with Bovatec®.

Growth stimulants implanted beneath the skin behind the ear include Compudose®, Ralgro®, Synovex® , Steer-oid®, Heifer-oid® and Finaplex-S®. Ralgro® is approved by the Food and Drug Administration for both steers and heifers. Synovex® has a separate implant for steers, heifers and calves under 400 pounds. Compudose® has been cleared for steers. Also, it is cleared for heifers fed in confinement for slaughter.

Compudose® is effective for approximately 200 days. The other implants last about 100 to 125 days except Finaplex-S® which has about 65 days efficacy. Implants have increased rate of gain by 8 to 15 percent and improved feed efficiency by 6 to 10 percent when cattle were fed growing and finishing rations.

Antibiotics in the ration of feedlot cattle generally give a slight improvement (3 to 5 percent) in rate of gain and feed efficiency. Improvement from antibiotics can be expected to vary greatly with different groups of cattle and feedlot conditions. Antibiotics are fed to reduce liver abscesses in cattle fed high-concentrate rations.

Be sure to follow label instructions for the number of days prior to slaughter that drugs and additives are to be withdrawn. (See MU Agricultural Guides 2090 "Growth Stimulants (Implants)", and 2075 "Feed Additives for Beef Cattle."

Special Considerations

Grains. Corn and milo are the principal grains fed to beef cattle. Limiting wheat to 50 percent and oats to 30 percent of the grain in finishing rations of beef cattle is recommended. Some experienced feeders use larger amounts of wheat successfully.

The price of grains should be compared with their nutritive value to select those to feed. The value of grain, especially milo, varies because of variety, processing methods and other factors. Milo is usually considered to be worth about 90 to 95 percent and wheat 100 to 105 percent the value of an equal weight of No. 2 corn in beef cattle rations.

Most processing methods improve the value of milo more than they do that of corn. This is because the starch of milo is less digestible. Processing methods developed for grains in recent years included high-moisture storage, steam flaking, grain exploding, popping, roasting and micronizing.

High-moisture grain. Milo harvested with a moisture content of 25 to 30 percent and ensiled has improved feed efficiency of cattle by 8 to 15 percent although it causes little increase in daily gain. Improvement from high-moisture processing of shelled corn has been less and more variable.

High-moisture milo or corn should be ground or rolled before it is fed. However, processing high-moisture corn in rations that have less than 15 percent roughage is questionable. See MU Agricultural Guide 2056, "High Moisture Grain for Beef Cattle."

Whole vs. ground dry-shelled corn. Dry, whole shelled corn has been equal or slightly superior to ground or rolled corn in high-concentrate beef cattle rations in many recent trials. Processing appears to have some value for dry-shelled corn in rations with 20 percent or more roughage content, or when corn is very dry, less than 12 percent moisture.

Mixture of Grains. Feeding a combination of grains or feeding a dry grain with a high-moisture grain can reduce acidosis and improve gain and feed efficiency about 5 percent. This is because grain type and method of processing influences the rapidity with which the starch in the grain is digested in the rumen and the proportion of the starch that is digested in the rumen vs the small intestine. Cattle fed a combination of 50 to 75 percent high-moisture corn and 50 to 25 percent dry corn or milo gained 5 percent faster and 4 percent more efficiently in University of Nebraska trials. Adding dry rolled corn or whole shelled corn to high-moisture milo rations improved the performance of cattle.

By-Product Feeds. By-products feeds may be a cheaper source of protein and energy for beef rations than conventional feeds. Your MU area extension specialist has a computer program to figure the relative value of feeds on the basis of their nutrient content. By-product feeds available to Missouri cattlemen include soybean hulls, corn gluten feed, distillers grains, brewers grain, corn bran, oat bran, rice bran, wheat mids, whole cotton seed and poultry litter.

High-concentrate rations. All-concentrate rations have been used successfully to finish beef cattle. With the possible exception of whole shelled corn, a higher level of management is needed, however, to make this system work under feedlot conditions. Problems associated with all-concentrate rations include reduced energy intake; founder and other digestive problems; parakeratosis of the rumen wall; and greater incidence of liver abscesses.

An optimum minimum roughage level in high-grain rations appear to be about 7 to 10 percent hay equivalent of the total ration. This would amount to approximately 1.50 to 2.50 pounds of hay or 6 to 8 pounds of silage per animal daily. In most cases, rate and consistency of gain have been slightly in favor of minimum roughage rather than all-concentrate rations.

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