UNIVERSITY OF MINNESOTA
Extension
SERVICE

BEEF COW NUTRITION FUNDAMENTALS

Lesson 1

Introduction

Several factors influence profitability in cow/calf operations including: percentage calf crop weaned, weaning (sale) weight, sale price, cull cow salvage value, and annual "carrying" cost per cow/calf unit. Feed represents the largest single cost of production in any livestock enterprise.
1995 reports from farm management associations in southeastern Minnesota reported annual feed costs per cow that ranged from $224 to $397 per cow. Minimizing feed costs, avoiding overfeeding and still maintaining healthy stock is a challenge for any producer, but staying productive while keeping feed costs down is a key to profitability.

Years of research efforts have been devoted to determine beef cow nutritional requirements. This unit will cover some basic considerations for cow nutrition and management.

Animal Digestion And Nutrient Requirements

Ruminants, such as cattle, are "natural grazers." They have a special organ in their digestive tract, called a rumen. The stomach of ruminants is composed of four compartments: rumen, reticulum, omasum and abomasum. The compartments are populated with microbes that break down most plant fibers. Because of this digestive system, ruminants can obtain most nutrients needed for growth and production from good quality pasture or forages.

Each forage may supply different proportions of total digestible nutrients (TDN). Nutrient requirements in beef cattle vary due to sex, age, weight, performance expected and stage of production. For optimum production and profits, match livestock nutrient requirements with forage nutrient levels.

Daily nutrient requirements of beef cows

Weight, lb	RFV	DMI, lb./d	TDN, lb./d	NE_m, Mcal/d	NE_g, Mcal/d	CP, lb/d	Ca, g/d	P,g/d	Vitamin A, 1000 IU
Dry mature cows - last third of pregnancy									
1200	76	22.3	11.8	10.83	-	1.7	26	21	29
Cows nursing calves - 20 lb. milk/d									
1200	98	23.8	15.2	15.49	-	2.7	39	28	41
Cows nursing calves - 10 lb. milk/d									
1200	82	23.0	12.8	12.09	-	2.1	28	23	42
Dry pregnant mature cows - middle third of pregnancy									
1200	66	20.8	10.1	8.68	-	1.4	18	18	26
Pregnant yearling heifers - last third of pregnancy									
950[a]	95	19.8	11.7	9.44	1.09	1.7	26	19	25
Two-year-old heifers nursing calves - 10 lb. milk/d									
1000[b]	100	20.8	12.9	10.98	1.14	2.1	29	22	37

[a]Gaining 1.4 lb/d.
[b]Gaining 0.5 lb/d NRC (1984)

SOURCE: 1995 Minnesota Beef Cow/Calf Report C-112 Page 33

Beef cows with high milking ability, for example, may not obtain sufficient nutrients from perennial grasses only. These cows may need to be fed a higher percentage of legumes or be supplemented with grain or a commercial energy source to maintain weight. On the other hand, a moderate weight, dry, pregnant beef cow can be maintained on forage containing 50% TDN.

A skill well worth learning, which can help you determine the nutrition levels of your feeding program, is body condition scoring (BCS). Research at the University of Minnesota and other universities has shown that visual evaluation of condition can be an accurate assessment of body fat reserves. With training and practice, producers can evaluate condition of their cow herds to sort cows into groups for feeding at appropriate levels. This can help save money and keep cows in proper condition for maintenance, production and reproduction.

A nine-point visual condition score (BCS) system has been devised and is a useful tool. Descriptions of the body condition scores are in the resource materials with this lesson, "Beef Cow Condition Scoring System."

Once producers understand body condition scores and the role energy or TDN plays in achieving a particular BCS, they can be better managers of their feeding program and their cows.

Water - A Primary Nutrient

Water constitutes about 98% of an animal's body. Water is needed for body temperature regulation, growth, reproduction, milk production, and digestion. Although livestock can get a great deal of water from lush forages (70 to 90% water), a good supply of clean water is essential in a grazing system. Water needs vary with temperature, humidity, animal size, milk production and diet. A dry cow's water requirement varies from 6 to 18 gallons per day. A nursing cow requires about 5 gallons more per day than a dry cow. Nonmilking stock grazing lush grass or grazing mid-winter, when there is snow cover, may have a reduced need for supplemental water.

The very nature of a ruminant animal requires that it be able to intake, eliminate and recycle large amounts of water every day. The total volume of all four compartments of the stomach of a mature cow is approximately 50 gallons, with the rumen (the largest compartment) accounting for about 40 gallons.

Cows generally drink their biggest share of water just after the morning grazing period. Both water quantity available and water quality need to be considered. Recommended distance to water varies with terrain of the pasture. Some range graziers consider water less than one mile from the farthest point of the pasture adequate, while other management intensive graziers will try to have water less than 1,000 feet from the farthest point. These distances will also depend on pasture/paddock size. Distance traveled to water will influence grazing patterns in a pasture.

Under moderately-intensive grazing management in paddocks of 10 or more acres, grazing periods of one or more days, and herd sizes of 200 head or more, the suggested water trough length in cattle country is about 1.5 inches times the number of animals in the paddock. This enables several cows to drink at one time without pushing others from the trough.

Under very intensive grazing management, many producers use 55 gallon plastic barrels split in half with a demand valve. Whenever water is readily available, and close by, drinking becomes more of an individual activity rather than the entire herd going to water at one time. This reduces the need for large water troughs or tanks in many cases.

Giving cows free access to ponds is a poor practice. Cow manure adds nitrogen and phosphorus to the water, which increases algae growth. Algae adds to water cloudiness, stagnation and odor which may decrease water consumption. If ponds are to be used for water, look for ways to gravity feed tanks below the dam or other methods to move water from the pond to the waterer. Fence the cattle out of the ponds and streams if possible.

Energy

After water, energy and protein are the primary nutrients to be considered.

The energy potential of feeds may be expressed in a variety of ways. One of the systems commonly used is "Total Digestible Nutrients" (TDN). TDN is a measure of the digestible nutrient content of a feedstuff or diet. Because energy is the largest single nutrient, measuring TDN gives an approximation of the energy value. It is defined as digestible crude protein (CP) plus digestible crude fiber (CF) plus digestible nitrogen free extract (NFE) plus 2.25 times digestible ether extract (fat).

TDN is expressed as a percentage. For example, corn's TDN value is 90%, which suggests in every 100 lbs. of corn, there are 90 lbs. of digestible nutrients. TDN is relatively easy to calculate from laboratory analyses, though it does tend to overestimate energy content of many feeds. In relatively simple diets, the TDN system can be a useful measuring method of expressing feed value (especially energy content) of a feed or diet.

Another system sometimes used to express energy is "Net Energy." Net energy systems express the value of feeds in meeting energy needs for maintenance, gain and lactation. See “additional resources” for an in-depth publication on net energy.

Energy content of feeds and the amount provided to animals becomes more critical under cold conditions. Severe winter weather can cause cows and heifers to lose body weight more quickly if they are underfed than mild weather will. Feed adjustments may need to be made to prevent losses in weight and body condition. As a general rule, increase feed 1% for each degree below the lower critical temperature. The estimated lower critical temperature for beef cattle changes with cattle hair coat. Lesson 2 will cover winter feeding in greater detail.

Survivability of calves depends significantly on nutrition their mothers get during the last 90 to 100 days before calving. Inadequate energy levels during this critical period can sap the strength of cows and unborn calves. The result often is weak calves that are slow to nurse. Inadequate nursing also decreases the natural protection that colostrum milk provides.

Energy intake and body condition at time of calving can also have considerable influence on how well cows cycle and rebreed following calving; thus paying attention to energy content of feeds pays dividends in several different ways.

Protein - The Building Block

Water and energy can go a long way toward keeping an animal alive, but in order to thrive and grow, protein is an essential nutrient of the ration. Protein can be supplied in a variety of ways, but a primary goal should be to provide protein in the most economical way possible. That usually means good quality forages, whether that is from stored hay or well-managed pastures.

Meeting protein needs of the pregnant cow is significant in preventing weak calves. Weak calf syndrome (WCS) may be an indication that the cow's crude protein consumption prior to calving was

inadequate. Symptoms of WCS include depression, general weakness and the calf's inability to stand. WCS frequently results in death within 10 days following calving.

Forages that are poor quality due to rain damage or other harvesting delays are often low in protein or energy. Forage qualities are highly variable and cannot be determined solely by visual evaluation. Proper forage testing to determine protein content can be an inexpensive tool in your nutrition management toolbox. Testing stored forages and using that information to build the rest of the feeding program usually pays off in significant protein supplement savings and/or healthier cows and calves.

Minerals and Vitamins

Mineral and vitamin supplementation is somewhat like an insurance policy for your nutrition program. When reproductive and/or health problems occur, many producers turn to exotic and expensive mineral or vitamins mixes for a quick solution. If so, you may be spending too much for mineral and vitamin supplementation. Many cow diets contain sufficient levels of these nutrients without supplementation. The old saying, "If it ain't broke, don't fix it" certainly applies. But, mineral deficiencies are usually a local or regional problem. No single program can be recommended for the entire state, and usually the solution to your individual problem cannot be bought in a bag.

Sodium and chloride (salt), calcium, and phosphorus are the macro-minerals in breeding herd diets. Additionally, vitamins and small amounts of "trace" minerals are important in a complete nutrition program.

Salt:

Because most plants provide insufficient sodium for animal feeding and may lack adequate chloride content, salt supplementation is a critical part of a nutritionally balanced diet for cows. Ruminants have such a strong appetite for sodium that they will return to the exact location of a salt source when they become deficient. Because animals have a definite appetite for salt, it can be used as a delivery mechanism to ensure adequate intake of less palatable nutrients and as a feed limiter. Cattle require 0.25% salt in the diet dry matter (DM). Young cattle will consume about 0.1 lb./day. Mature cattle will consume about 0.1 to 0.3 lb./day.

Trace Minerals:

Many beef nutritionists recommend feeding trace mineral salt to the breeding herd free-choice in the form of a mineral block or as loose trace mineral salt. This strategy will likely meet the trace mineral requirements of the cows in most cases. The trace mineral salt mixtures have guaranteed analysis on the tags. Your veterinarian, local nutrition advisor or neighbors will know if there are localized trace mineral deficiencies in your area. For example, a common magnesium deficiency symptom is grass tetany in beef cows grazing lush grass pastures in early spring. The risk of grass tetany is magnified on grass pastures heavily fertilized with N. Grass tetany can generally be prevented by feeding Mg in the free-choice mineral mix.

Calcium and Phosphorus:
Breeding cattle require calcium at 0.2% to 0.4% of diet DM, depending upon stage of production. Calcium deficiency is seldom a problem in cow herds because forages contain high Ca levels. The breeding herd will also require phosphorus from 0.2 to 0.4% of diet DM depending upon stage of production. Because forages vary in phosphorus content during the grazing season, many cow herds are low or marginal in P at some times during the year.

Vitamins:
The only vitamins of practical concern in every-day beef cattle nutrition are A, D and E.
Vitamin A requirements are 1270 IU/lb. DM for pregnant females, and 1770 IU/lb. DM for lactating females and bulls. Vitamin A is most apt to be deficient in high grain diets and/or when green forages are absent from the diet. Vitamin A can be injected with the benefit from the injections lasting for 90 to 100 days. Cattle exposed to direct sunlight on fed sun-cured forages will receive adequate vitamin D. Vitamin D is also available in an injectable form. Vitamin E is interrelated with selenium in white muscle disease in young calves, and has been implicated with selenium in reproductive problems in cows. Placental transfer of vitamin E to the fetus is low, so calves are born with low levels. However, vitamin E in milk of cows that received adequate E provides the newborn beef calf with its needs.

Examples of simple mineral mixes that will likely be useful under many circumstances

Ingredient (%)	Spring	Summer	Fall-winter
Trace mineral salt	35	65	45
Dicalcium Phosphate	30	30	50
Magnesium oxide	30	0	0
Dry molasses, ground corn or soybean meal	5	5	5

J.Wagner, Cattlemen's Satellite Shortcourse, 1994

Additional Resources and Reading

- Energy Requirements and the Net Energy System - NCR 572
  Author: Rust, Steven - 1995
  Source: Michigan State University
- Nutrient Requirements of Beef Cattle, National Research Council
- "Taurus" Least Cost and Ration Analysis Programs for Beef Cattle
- Cattlemen's Satellite Shortcourse Session 7, December , 1994: Cost Effective Supplementation
- Cornell Beef Production Reference Manual, Cooperative Extension Service, Cornell University
- University of Minnesota Extension Service "Beef Updates"

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