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Beef Cattle Nutrition Series

Part 1: Nutrition Basics

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Because feed costs are the major cost of producing beef, using feeds most efficiently is of prime importance in determining profits. Diets must be properly balanced so that feeds are used efficiently and cattle remain healthy. Ration balancing is an important management tool to maximize profits.

To begin ration balancing, some basic information about frequently used terms is needed. A **diet** is the amount of feed an animal receives in a 24-hour period. A **balanced diet** is the appropriate amount and proportions of nutrients needed for an animal to perform a specific purpose such as maintenance, growth, lactation or gestation. A **ration** is a portion of the feed that contributes to the total diet. For example, a supplement could be a ration (feed portion) balanced to correct deficiencies in the diet if the supplement was not offered.

Nutrients are feed components that aid in the support of life. The six basic nutrients are:

- Water
- Protein (amino acids)
- Carbohydrates
- Fats
- Minerals
- Vitamins

Nutrient requirements are the amount of nutrients the animal needs for a specific purpose. They are influenced by many factors, such as weight of animal, sex, desired rate of growth, stage of production such as gestation and/or lactation and environment.

The nutrient composition of a feed is the amount of specific nutrients contained in the feed. Most are expressed as a percentage of the dry matter and may also be found in published feed composition tables. A **word of caution:** feed composition tables contain only average values. Unless your feed is average, the data is not accurate. This is particularly true about forages.

Feed composition tables should be used when you have no other information. A chemical analysis of the feed can be done for a limited cost, and it will give much more accurate information. Contact your local county Extension office about feed analysis.

Common information provided from an analysis or a composition table will include **dry matter**, **crude protein**, **energy**, **fiber** and **minerals**.

Dry matter is the portion of the feed left after all water has been removed. It contains the nutrients. Values for dry matter intake shown in nutrient requirement tables represent an amount that can be consumed under normal circumstances.

Feeds contain various levels of dry matter; therefore, it is desirable to balance a ration on a dry matter basis and then convert the various feeds back to an as-fed basis when mixing and feeding.

Crude protein is determined by measuring the nitrogen content of feed and multiplying it by the value 6.25 because proteins typically contain 16 percent nitrogen. Not all nitrogen-containing compounds are true proteins. These are called nonprotein nitrogen (NPN) sources. Many of these NPN compounds can have their nitrogen converted to microbial protein in the rumen under proper conditions. Generally, NPN sources such as urea are not used as well as natural protein when cattle are on high roughage rations or have high protein requirements, such as young cattle with high rates of growth. True protein sources should be used for the majority of the supplemental crude protein in these cases.

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More advanced ration balancing accounts for protein that is degradable in the rumen (RDP) and protein that is not degraded in the rumen but is potentially degradable in the small intestine (RUP). For optimal microbial production in the rumen, a balance exists between the amount of energy that is supplied and the amount of protein that can be utilized to support the microbial population. If RDP is insufficient in the diet, microbial growth will limit the intake and digestibility of the ration.

Energy is not actually a nutrient, but it is contained within protein, carbohydrates and fats. For practical purposes, energy will be considered a nutrient. Several methods of indicating feed energy values are available. Some of these are digestible energy, net energy for maintenance (NE_M) and gain (NE_G) and total digestible nutrients (TDN). Total digestible nutrients is the value most commonly used in simple ration balancing.

Fiber is an estimate of structural carbohydrates found in plants. Fiber limits the energy value of plants for monogastrics, but the microbes in the rumen are capable of utilizing the fiber, providing energy to the ruminant. Grazing ruminants rely on the breakdown of fiber by microbes in the rumen for their energy source. Some high fiber feeds, such as rice hulls, are poorly digested but others, such as soybean hulls, are highly digestible. A minimal fiber requirement is necessary to maintain a healthy rumen for cattle fed a high grain ration. Providing fiber for this reason is sometimes referred to as "scratch factor." Fiber helps moderate the rumen pH through the process of rumination which stimulates saliva production. This is very important in preventing metabolic disorders when feeding a high grain diet that is common to backgrounding operations, feedlots and on-farm bull test programs. Some feeds may appear to contain sufficient fiber, but if the feed is of small particle size, the fiber will not be effective in keeping a healthy rumen. High grain diets should be balanced to contain a minimal crude fiber or effective fiber (effective NDF) level to ensure adequate fiber to stimulate rumination and provide sufficient scratch factor.

Minerals are compounds needed for structural integrity, metabolic function and immune function. They are classified as macro minerals or trace minerals depending on the amounts needed.

Macro minerals are generally fed as a percentage of the diet, whereas trace minerals are required and added to diets in a much smaller amount. Trace minerals are generally discussed in parts per million (ppm).

Macro Minerals	Trace (Micro) Minerals
Calcium (Ca)	Iodine (I)
Phosphorus (P)	Cobalt (Co)
Magnesium (Mg)	Iron (Fe)
Potassium (K)	Manganese (Mn)
Sodium (Na)	Copper (Cu)
Chlorine (Cl)	Zinc (Zn)
Sulfur (S)	Selenium (Se)

Vitamins, like minerals, play an important role in metabolic function, and some act as antioxidants, which are compounds that help prevent oxidative damage to cells. Vitamins can be grouped into two categories, fat soluble and water soluble. The fat-soluble vitamins A, D and E are most likely to become deficient in beef cattle diets, depending on the feed resource and where the cattle are confined. Water-soluble vitamins are readily synthesized by the rumen microbes and, therefore, are less likely to become deficient.

Water is generally not discussed in great detail because beef cattle generally have free access to water. However, when water intake is not adequate, feed intake and performance will be reduced. Many factors such as number of head, animal size, air temperature and humidity, and distance between watering sources affect water volume requirements that must be considered when developing a water supply. In addition, knowledge of mineral composition of water is important to ensure minerals do not exceed toxic levels or affect animal performance. For example, some wells produce water that is high in sulfur, and this would affect the copper requirement of the cattle. The normal water needs are approximately 1 gallon per 100 pounds of body weight for beef cattle consuming water from a manually filled stock tank.

Complementary Publications

Water for Beef Cattle (FSA3021)
Mineral and Vitamin Supplementation of Beef Cows in Arkansas (FSA3035)

Beef Cattle Nutrition Series Publications

Part 1. Nutrition Basics (FSA3078)
Part 2. Establishing Nutritional Requirements (FSA3079)
Part 3. Nutrient Requirement Tables (MP391)
Part 4. Formulating Rations (FSA3080)

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