



# Basics for Livestock and Equine Nutrition

**Ruminants are animals whose digestive system contains fermenting microbes that help to digest forage.**

## Components of a Ration

- Water**
- Protein**
- Energy**
- Fiber**
- Minerals**
- Vitamins**

### **Introduction:**

The most important aspect in keeping livestock healthy and able to produce is a proper nutritious diet. Cattle belong to a class of animals called ruminants. This group also includes sheep and goats. Ruminants have a digestive system which allows them to efficiently digest and absorb most of their nutrients from forages. There are four compartments in the beginning of the digestive tract, one of which is called the rumen that contains near 50 gals of fluid and ingested forage. The rumen has a large population of microbes, mainly bacteria and some protozoa, which allows for the degradation of the fibrous material in forage. Much of the initial digestion of feed is done by microbes in the rumen. Sheep and goats are also ruminants, but the initial digestive tract compartments are of different proportions and configuration than cattle. They are often referred to as "small ruminants". The horse is a non-ruminant herbivore. These animals do not have a multi-compartmented stomach as cattle do, but are able to consume and digest forage. The cecum and colon, parts of the large intestine, serve the somewhat same purpose for the horse that the rumen does for the cow. Llamas and alpacas are "pseudo-ruminants" because they have three continuous compartments in the fore digestive tract instead of four like ruminants. Swine utilize different types of feed than ruminants, due to the differences in their digestive systems. Swine are monogastrics, meaning they only have one stomach which is similar to that of humans. Usually grains are the main part of a swine's diet. They can eat a portion of their diet from pasture, although the forage from the pasture needs to be of high quality. The diet for livestock is usually referred to as a ration and a balanced ration is the amount of feed that will supply the proper type and proportions of nutrients needed for an animal to perform a specific purpose.

### **The Six Basic Components of a Ration:**

**Water** - Water is often over looked but is the most critical component of any ration. It is essential in allowing most of the physiological functions in the body. Water has been a difficult nutrient to determine the actual requirement for many livestock primarily because water is usually provided free of choice. When water is limited in a ration, the dry matter intake is reduced and the correct amount of nutrients for the animal is restricted.

**Protein** – Protein is needed for the structuring of muscles, skin, hair and internal organs and is the only food source of nitrogen. Crude protein is the total protein content of a feed. Since proteins contain 16% nitrogen on average, knowing the total amount of nitrogen will determine an approximate amount of protein in the feed. Proteins are composed of amino acids and each protein has a variety of the 22 amino acids in different quantities. Many amino acids are synthesized in the body, but there are eight amino acids that are not synthesized and need to be provided in the ration. These are called essential amino acids. The digestion and absorption of amino acids and nitrogen is different in each species of livestock.

**Energy** - Energy allows the animal to do physical work. It also provides the ability to grow, lactate, reproduce, and enable other physiological functions such as feed digestion. Energy is not actually a nutrient but a total caloric value of a feed. There are several chemical, mechanical, and mathematical methods to determine feed energy values.

Some of these are called digestible energy, metabolizable energy, net energy, and total digestible nutrients. A total digestible nutrient (TDN) is the energy value most commonly used in simple rations. Each ingredient in a ration has a different digestible energy value and of those values there is a different amount of energy that is metabolized and used in the body.

**Fiber** –Crude fiber is an estimate of structural carbohydrates found in plants and grains. It has a varying amount of digestible material from high to low in cellulose and lignin respectively. Fiber limits the energy value of plants for monogastrics such as pigs, but the microbes in the digestive tracts of the other livestock species mentioned above are capable of utilizing the fiber which provides energy in the ration. Fiber also provides the necessary bulk in the digestive tract and regulates the time of passage of food. This helps to maintain a population of microorganisms which are critical for healthy digestion.

**Minerals** - Minerals are very much needed for the physiology of structure, metabolic and immune functions in the animal. There are two classifications of minerals. Macro minerals (calcium, phosphorous, sodium, chlorine, magnesium, potassium, and sulfur) are those that are required in the most amounts in a ration compared to minor minerals (iron, copper, molybdenum, manganese, zinc, cobalt, iodine, and selenium, and others) which are needed in less amounts.

**Vitamins** - Vitamins are similar to minerals in that they take part in many physiological functions, including coenzymes for metabolic functions and antioxidants, which are compounds that help prevent damage to cells. Vitamins are grouped into two categories, fat soluble and water soluble. Many of the important vitamins for forage eating animals are either synthesized by microbes in the digestive system, obtained from sunlight, or are stored in the liver. Many of those vitamins that are not made in the animal are easily provided in adequate amounts in the forage.

### The Basics for Livestock Rations:

Every ration will be different depending on species, age, size and weight, gender, stage of reproduction, demands for production or work, and environment. The proper formulation of rations for livestock is dictated by appropriate nutrient requirements for each type of animal under a variety of conditions. The National Academy Press publishes a series of tables about nutrient requirements for livestock. The National Research Council (NRC) compiles the data for these publications which can be purchased or read online from the web site listed below. In addition to knowing the nutrient requirements, it is also necessary to know the nutrient composition of each feedstuff per ration. While the book value forage analysis is good information to compose a proper ration, when possible it is best to sample the individual feedstuff used and have it analyzed. The greatest variation between the book value and the actual value is in forages. Certified forage analyzing laboratories are in the listing of The National Forage Testing Association lists.

### Resources:

Nation Academy Press can be accessed at: <http://www.nap.edu/topics.php?topic=276>

For a list of forage analyzing laboratories go to National Forage Testing Association at: [www.foragetesting.org](http://www.foragetesting.org)

For more information visit [www.umass.edu/cdl](http://www.umass.edu/cdl)

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