

Cattle Producer's Handbook

Nutrition Section

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Beef Cattle Nutrition: Feeding the Cow and the Rumen

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Cattle and other ruminant animals have the remarkable ability to consume relatively low quality diets, yet produce high quality products such as meat and milk. The reason for this phenomenon is the incredible symbiotic relationship between the cow and microorganisms in her rumen. All parties involved in a symbiotic relationship benefit. In this case, the microorganisms are provided food in a temperature-regulated, oxygen-free environment necessary for their survival, while the cow uses the end products from microbial digestion for energy and utilizes the microorganisms themselves as a protein source. Cattle producers can take advantage of the cow-rumen relationship to produce a calf more efficiently.

This fact sheet will provide a framework for livestock managers to understand how their cattle use feeds provided to them, as well as a brief overview of how this information is incorporated into the 1996 edition (and 2000 Update) of 300, *Nutrient Requirements of Beef Cattle*, published by the National Research Council (2000).

Ruminant Anatomy and Rumen Function

Cattle are sometimes referred to as four-stomached animals. More accurately, they have one stomach containing four compartments: rumen, reticulum, omasum, and abomasum (Fig. 1). The first two compartments, the rumen and reticulum, are essentially a large fermentation vat, where bacteria and other microorganisms partially break down feed. Fermentation in the rumen yields end products that the host animal can use to meet its nutrient needs.

The rumen of a mature cow is large, with a capacity to hold between 40 to 60 gallons. Muscular contractions of the rumen and reticulum mix feed with microorganisms to promote fermentation and allow for the regurgitation

of feed (cud chewing) to reduce particle size. Copious amounts of saliva are produced, which helps to neutralize acids produced by microorganisms during fermentation.

The short-chained acids produced during fermentation are called volatile fatty acids (VFAs), which the cow uses as an energy source. The inside of the rumen is covered with fingerlike projections called papillae that dramatically increase the surface area available to absorb nutrients (e.g. VFAs). A severe drop in rumen pH or prolonged time at low pH can easily damage ruminal papillae and can occur as a result of excessive grain or insufficient fiber feeding.

The omasum is the next compartment that feed encounters in the gastrointestinal tract. It is located on the right side of the animal and is about the size of a basketball. Feed flows to the omasum only when it is of small enough particle size to pass through the omasal opening. Normally, particles greater than 2 mm (0.08 inch) do not pass out of the rumen. Large fiber particles in manure are an indication of improper

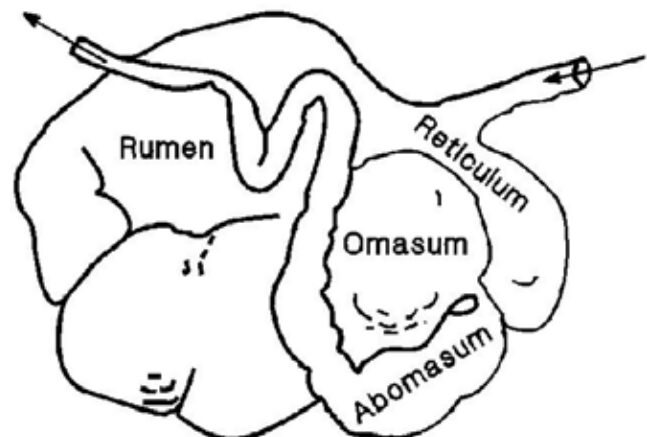


Fig. 1. Diagram of the ruminant four-compartment stomach. Kansas State University.