Feed digestion in cattle is a two-step process. First, the bulk of the feed consumed by the animal is digested by microbes in the rumen. Second, the microbes and any residues they have not broken down are digested by the animal itself. The way that you process feed, formulate rations and manage feed delivery have important effects on the efficiency of microbial digestion. And the efficiency of microbial digestion has a direct effect on the amount of milk your cows produce from the diets they consume.

Experiments at the Lethbridge Research Centre over the past twenty years have helped us understand the way that rumen microbes process feed. Understanding this process can help you maximize production from the diets you offer your cattle.

**Microbial digestion**

Before microbes begin the process of digestion, they must first attach themselves to feed particles. They do this by secreting a sticky, mucous-like envelope onto the feed which serves as a bridge for attachment and reduces their chances of being washed off.

Once attached, microbial cells multiply to form colonies at the site of attachment and begin to release digestive enzymes which break down the feed. The attachment envelope improves the efficiency of digestion by trapping the microbial enzymes in close proximity to the feed. In addition, the envelope reduces escape of intermediate products of digestion.

Other types of microbes are soon attracted to the attachment site to share the spoils of digestion. Eventually, a diverse mixture of microbial types establish colonies in the area, each digesting either specific parts of the feed particle or particular by-products of digestion. The photograph below, taken with an electron microscope, shows the diversity of microbes involved in rumen digestion of barley.

Regular contractions mix rumen contents and propel colonized feed particles both up the esophagus for rechewing (rumination: cud chewing) and down the digestive tract for further processing. Microbes that are dislodged from their attachment sites by these movements are free to attach and establish colonies on fresh feed entering the system.

**Grain processing**

Method and degree of grain processing affect the rate of microbial attachment, colonization and digestion of grain. Whole grain is almost completely indigestible by rumen microbes – the surface of an intact grain kernel effectively resists microbial attachment and prevents microbes from gaining access to the starch and other digestible nutrients inside. When whole barley is fed, it is chewed both at the time of eating and later, during rumination. Chewing breaks the hull and allows microbes to attach and digest the grain. Depending on the amount of whole barley fed and the rate of consumption, 5 to 15% of the kernels may escape chewing and appear in the manure.

Coarse-rolled barley, where the hull is cracked without shattering the kernel, is digested slowly because of the time required for microbes to access internal nutrients. Cracks in the hull provide access points for ‘inside-out’ digestion of the kernel.

Finely rolled or hammered grain offers a very large surface area for microbial attachment; breakdown of starch is extremely rapid and the risk of acidosis increases due the accumulation of acids produced in the process of digestion.

source: Tim McAllister & K.-J. Cheng, Agriculture & AgriFood Canada, Lethbridge Research Centre